SESAME – a Regional Research Opportunity

Andrea Lausi

The origins of SESAME

Sergio Fubini

Eliezer Rabinovici

CERN/MESC Middle East Scientific Cooperation

January 1995 in Cairo

Memorandum of Understanding
to establish a
Condensed Matter, Environmental and High Energy Physics
Collaborative Research
in the Middle East

I. Introduction

Under the auspices of Prof. Dr. Venice K. Gouda, Minister of State for Scientific Research of the Arab Republic of Egypt, and as a continuation of the correspondence between representatives of: the National Research Centre (Cairo), the Racah Institute of Physics, Hebrew University of Jerusalem and the Physics Departments of the Universities of Cagliari and Torino, a working visit of Prof. Alberto Devoto (University of Cagliari), Prof. Sergio Fubini (University of Torino), and Prof. Eliezer Rabinovici (Hebrew University, Jerusalem) was held in Cairo on January 7 and 8, 1995. The Egyptian participants in these meetings were:

1. Prof. Dr. M.M. El Halwagi, First Under-Secretary, Ministry of State for Scientific Research of the Arab Republic of Egypt
2. Prof. Dr. Naiel Barakat, Professor of Experimental Physics, Ain Shams University
3. Prof. Dr. Sawsan Abdel Zaher, Head of Physics Division, NRC
4. Prof. Dr. Ahmed Fakhri, Research Professor, Atomic Spectroscopy, NRC
5. Prof. Dr. Mohamed Tag Eldin, Head, Theoretical Physics Dept., NRC
6. Mr. A.I. El-Ibiary, Legal Advisor for NIOF.

The purpose of the meetings was to outline practical ways for collaboration in the fields of Condensed Matter, Environmental and High Energy Physics within the context of the above-mentioned parties.

It was agreed that:

i) It is of great importance to strengthen the scientific relationships between the above-mentioned parties in the various fields of Condensed Matter, Environmental and High Energy Physics for the benefit of common human knowledge.

ii) The parties recognize that important scientific achievements in Condensed Matter, Environmental and High Energy Physics can only be achieved through meaningful and sincere collaboration between experts, independently of their nationalities.

iii) Training of young scientists and researchers is of major importance and all the involved Institutions have the responsibility of contributing to their training in Condensed Matter, Environmental and High Energy Physics.

For these reasons the above-mentioned Institutions will take the initiative in developing a fruitful collaboration both in research and training.

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IV. Finance

In order to develop a long-term collaboration, the parties agree to prepare joint research projects to be submitted in the near future to International funding agencies and World Organizations.
The parties agree not to delay the actual collaborative activities until the approval of the above-mentioned research projects and agree to start the collaborative work with the available funds.

To this end:

a) Travel expenses, accommodation and per diem of Egyptian and Israeli scientists invited to courses and scientific activities in the Italian Institutions will be taken care of by the Italian Institutions.
b) The Egyptian side will provide accommodation for Israeli and Italian Scientists invited to stay at Egyptian Institutions, within the scope of joint reserach collaboration (this does not include the International meeting mentioned under item III(c), for which special funding arrangements will be sought).
c) Travel expenses, accommodation and per diem of Egyptian and Italian scientists and students invited to courses and scientific activities at the Racah Institute will be taken care of by the Israeli Institute.

In summary, the above-mentioned Institutions consider this agreement as a sound base for collaboration in both research and training.

Signed in Cairo on January 8, 1995, in three originals in English.

Prof. Dr. Mohamed Mokhtar El Halwagi
M.M. El Halwagi
First Under-Secretary of State
Ministry of Scientific Research
of the Arab Republic of Egypt
Cairo, Egypt

Sergio Fubini
Prof. Sergio Fubini

Representative of the
Scientific Committee
for the Middle East
Workshop
Torino, Italy

Eliezer Rabinovici
Prof. Eliezer Rabinovici

Chairman
Racah Institute of Physics
Jerusalem, Israel

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The origins of SESAME

Sergio Fubini

Eliezer Rabinovici

CERN/MESC Middle East Scientific Cooperation

November 1995 in Dahab, Egypt

INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
I.C.T.P., P.O. BOX 586, 34100 TRIESTE, ITALY, CABLE: CENTRATOM TRIESTE

Trieste, July 20, 1995

Prof. S. Fubini
Chairman of the
Scientific Commitee for the Sinai School of Physics,
Universita di Torino
Torino, Italy

cc: Prof. G. Denardo
Prof. A. Devoto
Prof. E. Rabinovici

Dear Prof. Fubini,

I'm happy to let you know that the ICTP has decided to grant a special contribution of 22,000 $ for the organization of the "Sinai Meeting on High Energy Physics, Condensed Matter and Environmental Physics" to be held in Dahab (Egypt) from 19 to 26 November 1995.

This contribution will be given to the Organizing Committee at its address in Israel.

Yours sincerely,

Miguel A. Virasoro
ICTP Director

STRADA COSTIERA, 11 TEL. 2240111 TELEX 224163 TELEX 460392 ADRIATICO GUEST HOUSE VIA GRIGNANO, 9 TEL.224241 TELEFAX 224531 TELEX 460449

Action plan for a collaborative programme in physics in the Middle East.

As part of the implementation of the collaboration agreement signed in Cairo on January 8th ,1995 under the auspices of H.E. Prof. Dr. Venice K. Gouda, Minister of State for Scientific Research of the Arab Republic of Egypt;

In the spirit of the agreement to promote co-operative work in fields that have impact on peoples' lives and standards of living, facilitating the use of equipment and expertise to support and collaborate in the ongoing peace process;

As a consequence of fruitful discussions among scientists of the Middle East held during a successful meeting in Dahab, Sinai from November 19 to November 26, 1995 under the chairmanship of Professor Sergio Fubini, acting also as delegate of the Minister of University and Scientific and Technological Research of Italy, attended by 125 scientists: American, Argentinian, British, Egyptian, French, German, Israeli, Italian, Japanese, Jordanian, Moroccan, Palestinian, Spanish, and honoured by the presence of Prof. Dr. Venice K. Gouda, Minister of State for Scientific Research of the Arab Republic of Egypt, Prof. Jacob Ziv, President of the Israel Academy of Science and Humanities, Prof. Miguel A. Virasoro, Director of ICTP and Dr. Adnan Badran, Deputy Director-General of UNESCO;

It was decided:

-To create a "Steering Committee for International Collaboration in the Middle East on Basic and Applied Physics" under the auspices of UNESCO, ICTP and the Italian government.

The tasks of this committee will be:

1. To promote collaboration between scientists in Egypt, Israel, Italy and other scientists in the region; to identify research groups with common interests and to facilitate research collaboration and the exchange of scientists and students;

2. The committee will initiate, promote and support other meetings and regional Schools of Physics. The next School is planned to take place in Jerusalem and Bethlehem in May 1996, on the subject of the Physics of Detectors.

3. The establishment of a computerized data base of regional scientific and educational activities for the benefit of all students and researchers in the area, with a view to connecting the institutions and groups active in research and education.

A. Rabbani
ASE

E. Rabinovici

Why Build a Synchrotron Facility?

- International collaboration is obvious way for countries with relatively small scientific communities and/or limited science budgets to build a synchrotron-light source.
- Broad programs make synchrotron-light sources ideal facilities for building scientific capacity.
- SESAME will be a user facility: scientists will typically go to SESAME two or three times a year for a week or two to carry out experiments, in collaboration with scientists from other institutions/countries.

The origins of SESAME

Sergio Fubini

Eliezer Rabinovici

Gustav Voss

Herman Winick

1997: building a light source in the Middle East using the decommissioned Berlin Synchrotron, BESSY I.

The origins of SESAME

Sergio Fubini

Eliezer Rabinovici

Herwig Schopper

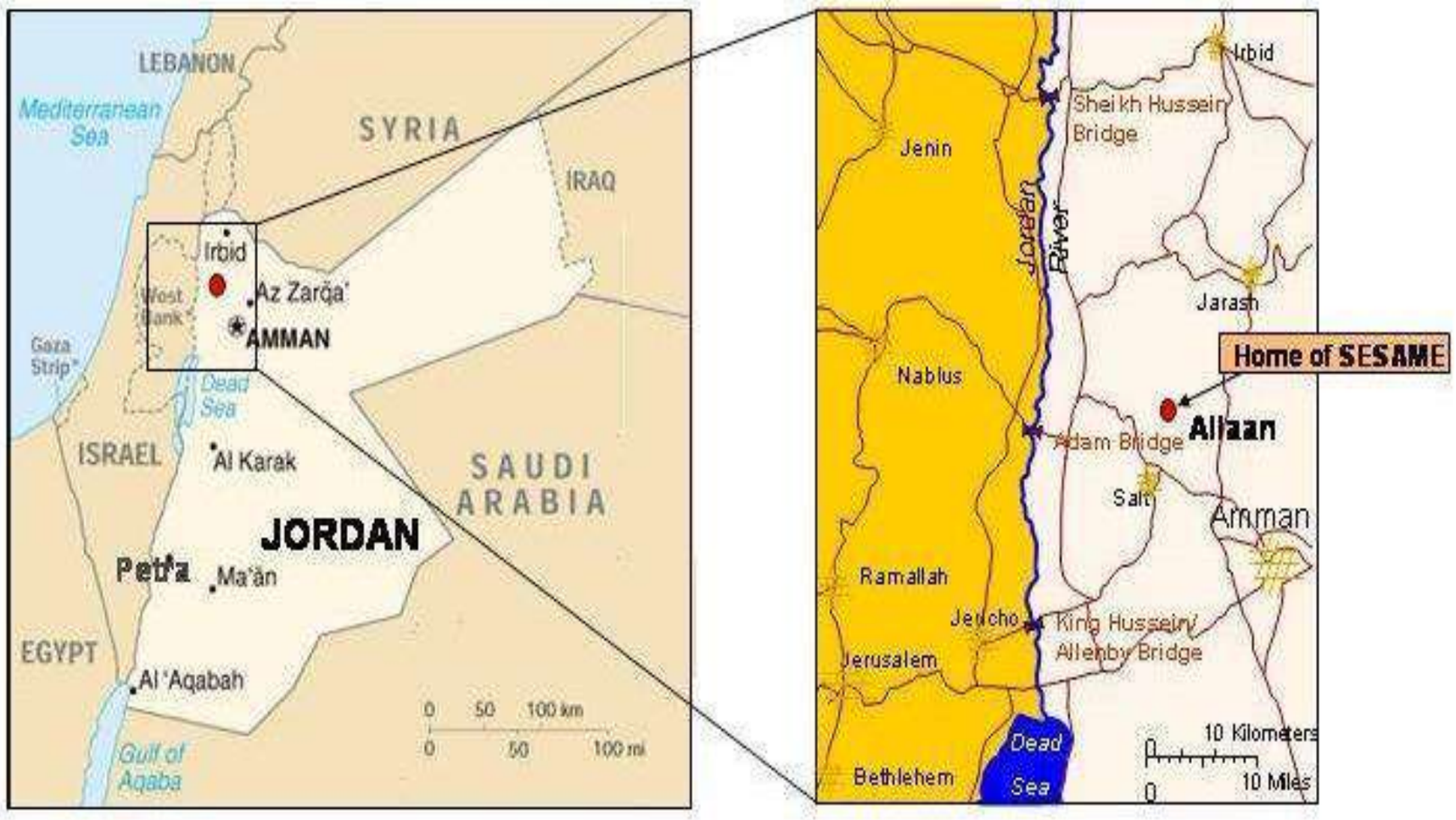
Gustav Voss

Herman Winick

Isa Khubeis

Jordan

SESAME Location



SESAME as a Project

United Nations
Educational, Scientific and
Cultural Organization

SESAME is a cooperative venture by scientists and governments of the region set up on the model of CERN (European Organization for Nuclear Research) although it has very different scientific aims.

It was developed under the auspices of UNESCO (United Nations Educational, Scientific and Cultural Organization) following the formal approval given for this by the Organization's Executive Board (164th session, May 2002).

SESAME Members and Observers

Members:

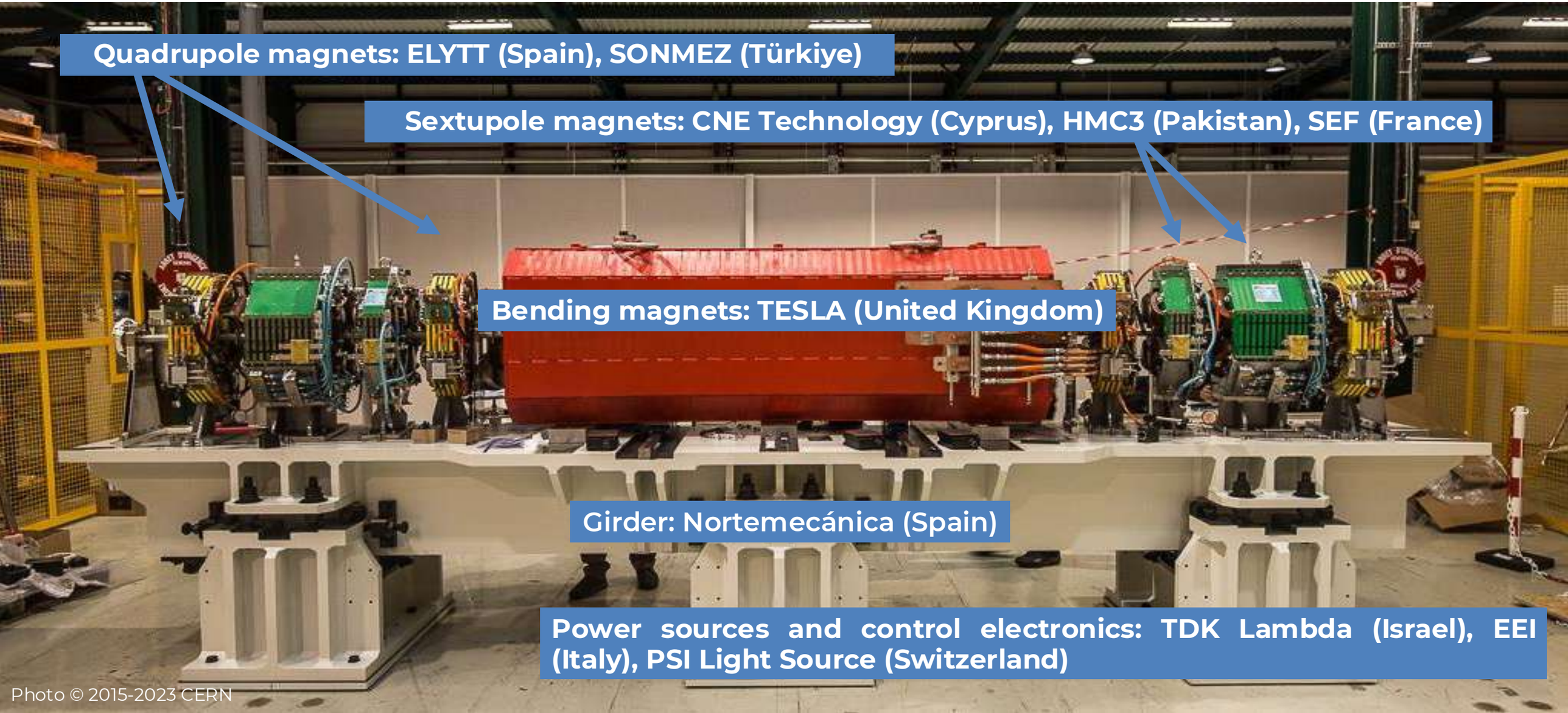
Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestine, Turkey

Observers:

Brazil, Canada, CERN, China, EU, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russia, Spain, Sweden, Switzerland, UAE, UK and USA

CESSAMag

Magnets designed at SESAME,
procured by SESAME/CERN EC FP7 project CESSAMag
QA/QC at ALBA (Spain) and at CERN



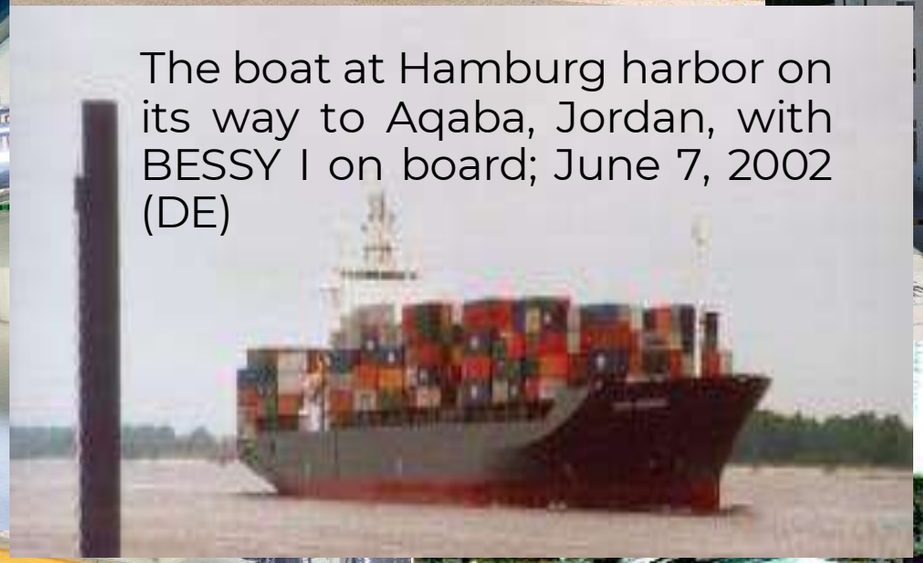
SESAME received much support from non-members. Examples are…


Solar Power Plant (EU)

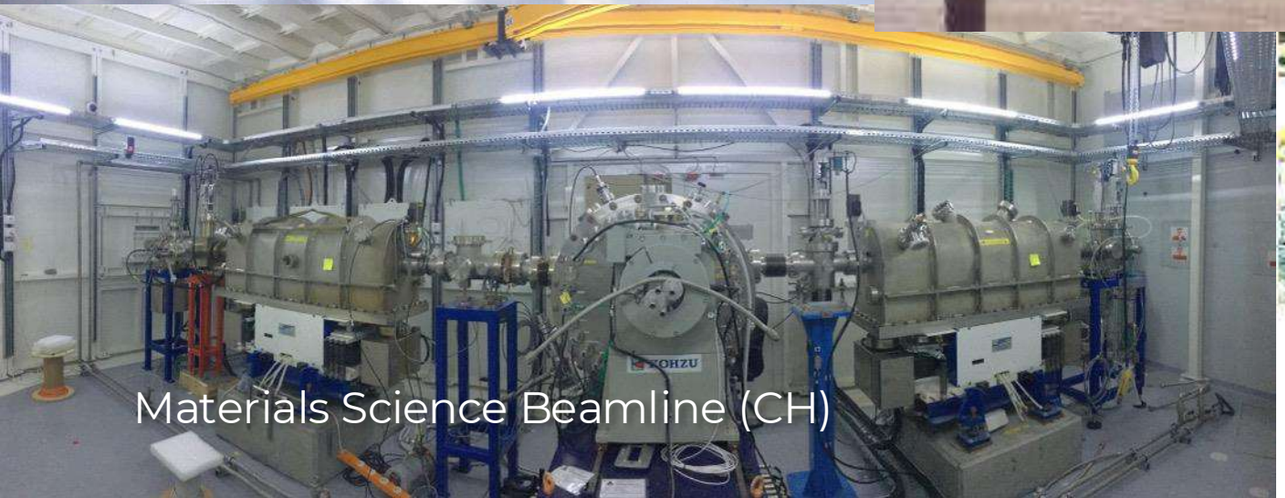

Sergio Fubini Guest House (IT)


HESEB Beamline (DE)

Photo © Ivan Lim


The boat at Hamburg harbor on its way to Aqaba, Jordan, with BESSY I on board; June 7, 2002 (DE)


XAFS/XRF Monochromator (UK)


Materials Science Beamline (CH)


The four RF Cavities (IT)

His Majesty King Abdullah II following the opening of SESAME, flanked by Heads of the delegations of the SESAME Members and D irectors of International Organisations that have supported SESAME. To the King's left, HRH Princess Sumaya of Jordan, who headed the Jordanian delegation, and Fabiola Gianotti, Director General of CERN; to the right, Irena Bokova, Director-General of UNESCO, Carlos Moedas, European Commissioner for Research, Science and Innovation, and Rolf Heuer, President of SESAME Council

SESAME Energy Balance

6.5 MW Solar Power Plant
Financed by EU

Average Annual Production:
11.57 GWh
CO_2 Saved: -7,104 Ton

MAX Peak Load: 2.1MW
Average Annual Consumption: 9.7GWh
CO_2 Saved: - 5,955 Ton

Cooling System: 542kWh

Storage Ring Magnets: 521kWh

Main RF System: 480kWh

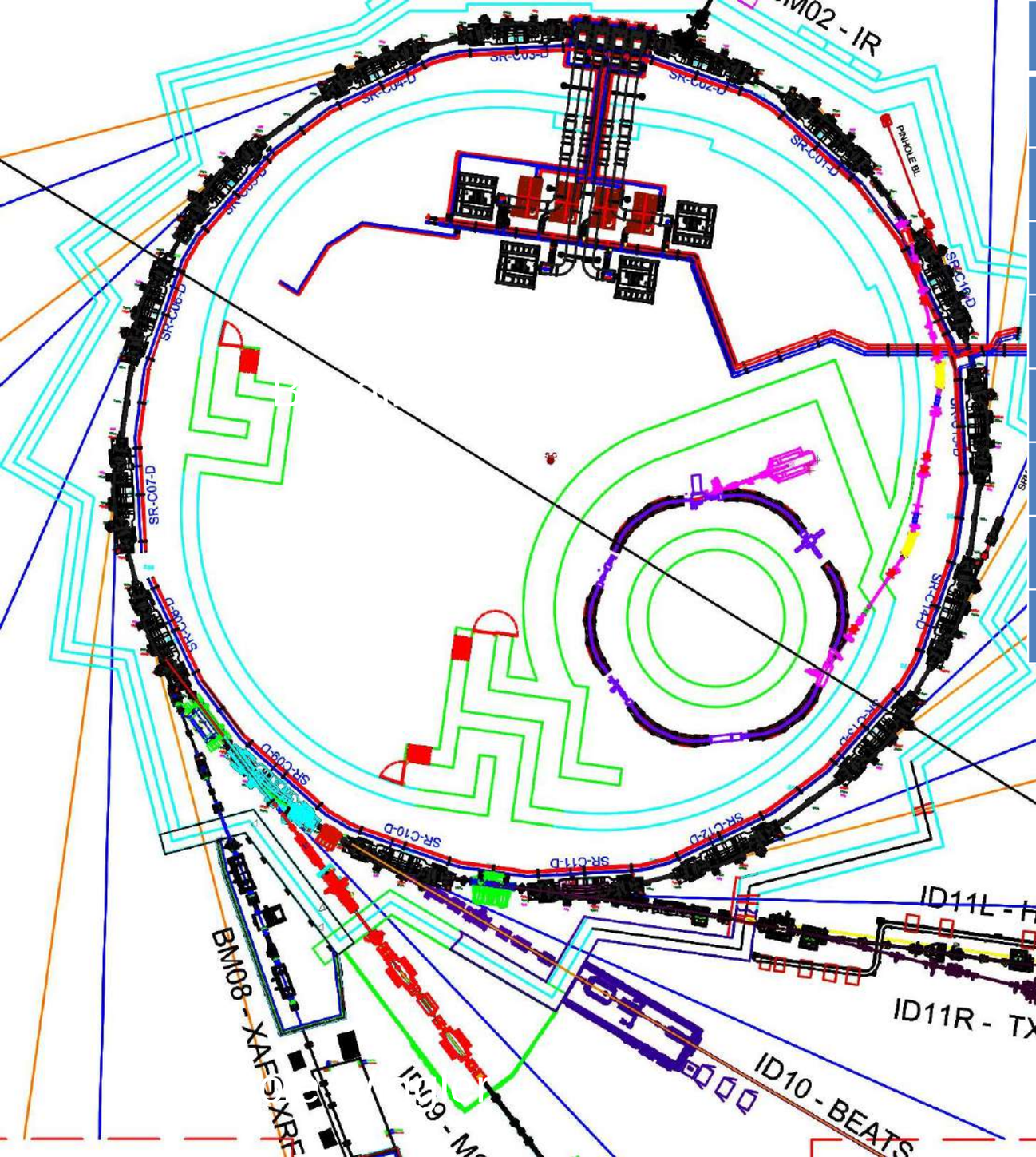
SESAME Main Building: 100kWh

Injector (Microtron & Booster): 62.5kWh

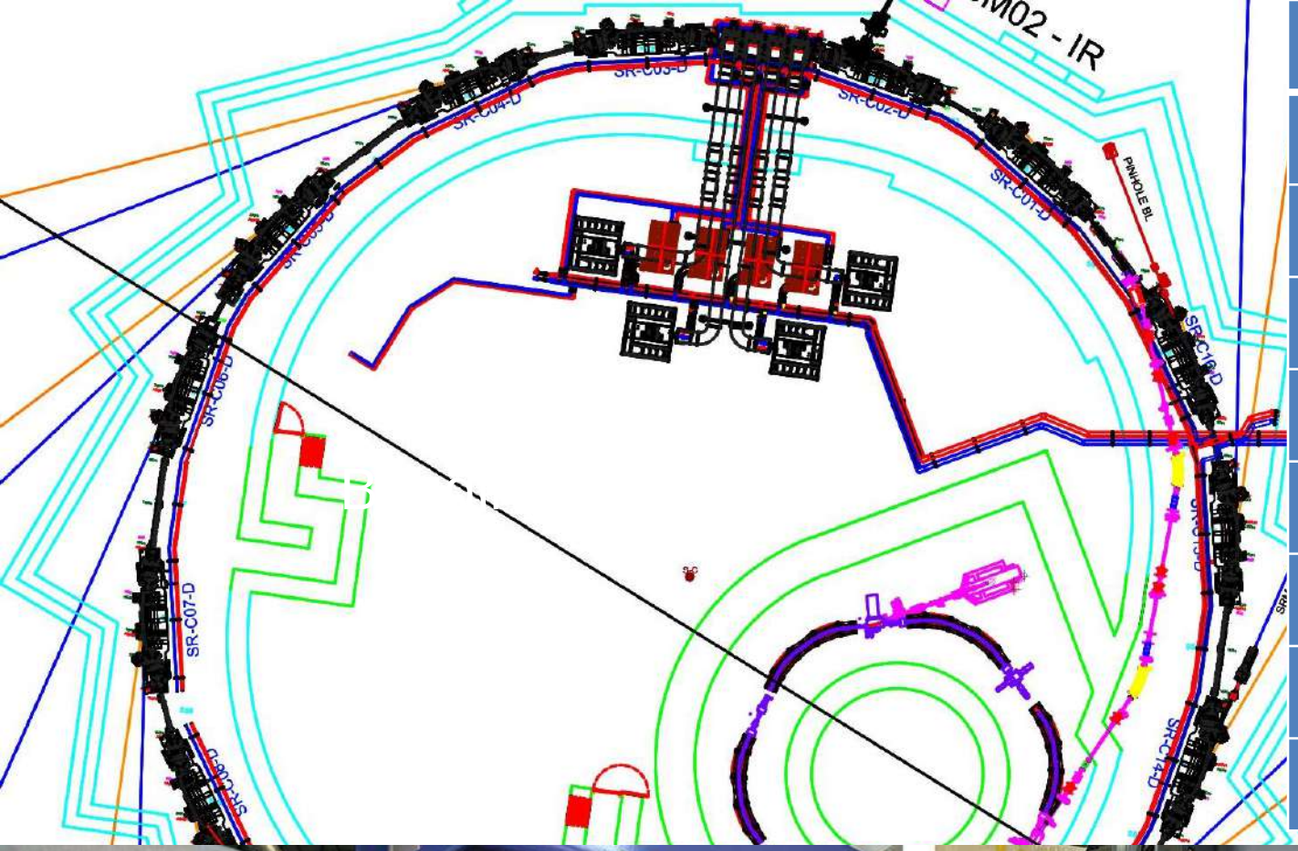
The Status of SESAME

3rd generation light source
2.5 GeV
133 meters circumference
5 operational beamlines
70 international staff

Photo © Ivan Lim



SR parameter	Value
Energy	2.5 GeV
Circumference	133 m
Emittance	26 nmrad
Current	300 mA
RF frequency	500 MHz
# cavities	4
Long straits	8 (4 m)
Short streights	8 (2 m)



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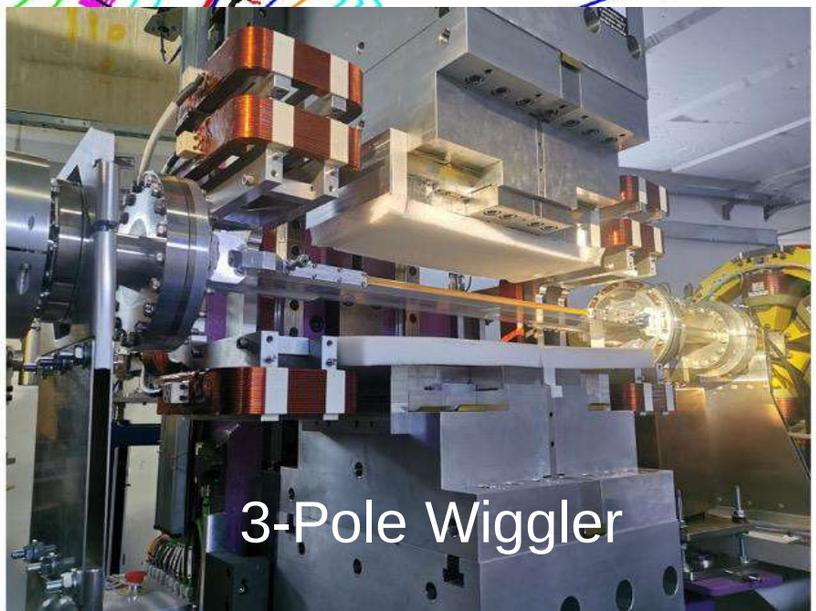


Five Beamlines are in Operation

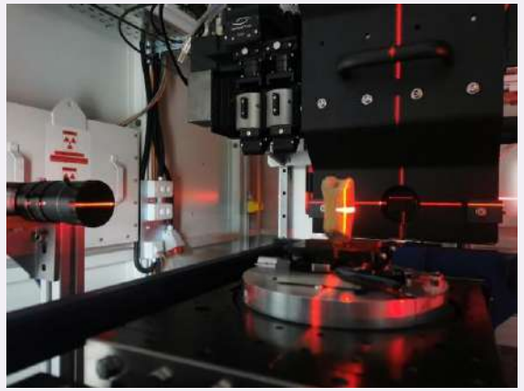
Two Bending Magnet Beamlines

BM02 – IR
Infrared Spectromicroscopy

BM08 – XAFS/XRF
X-ray Absorption Fine Structure
X-ray Fluorescence Spectroscopy

Three Insertion Device Beamlines

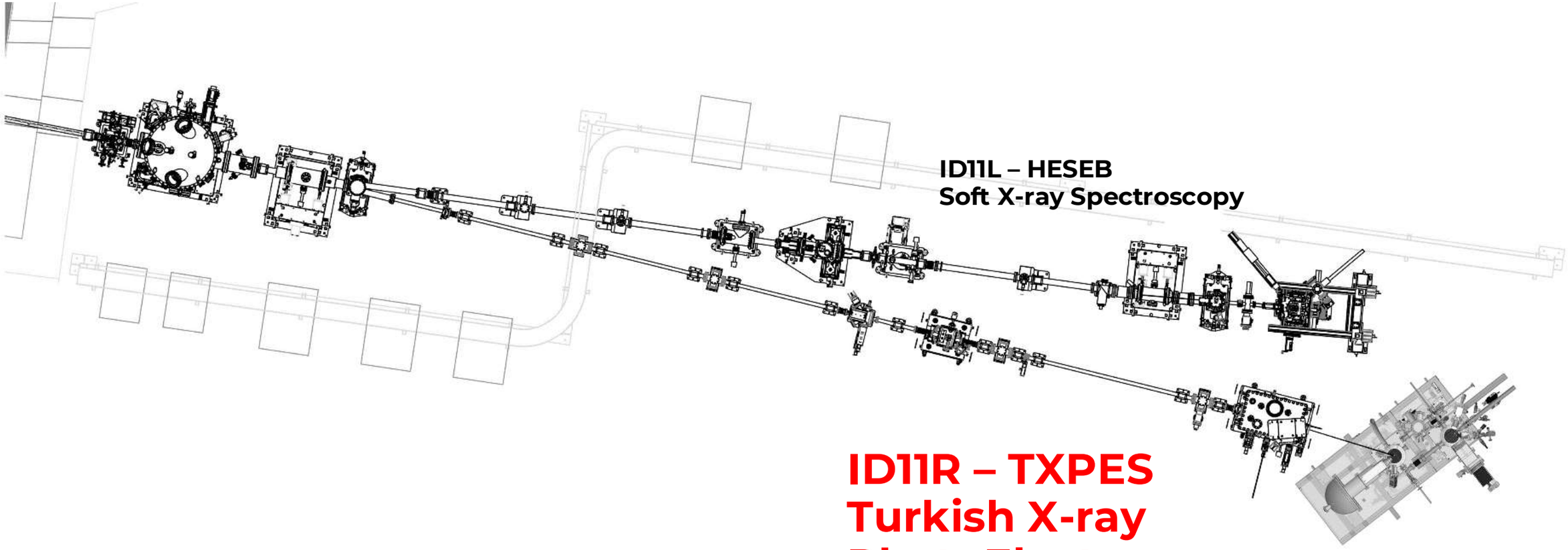
ID09 – MS/XPD Materials Science
X-ray Powder Diffraction



ID10 – BEATS
X-ray Tomography

ID11L – HESEB
Soft X-ray Spectroscopy

One Beamline under Construction



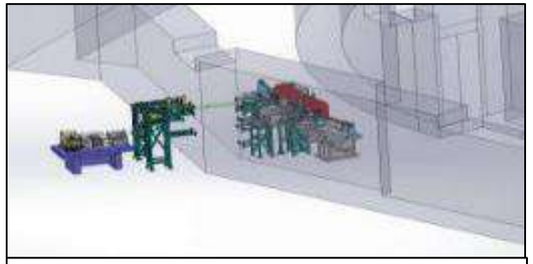
ID11L – HESEB
Soft X-ray Spectroscopy

ID11R – TXPES
Turkish X-ray PhotoElectron Spectroscopy

1. BM02 - IR

SESAME's First Fully Designed Beamline

in collaboration with the French Synchrotron, SOLEIL



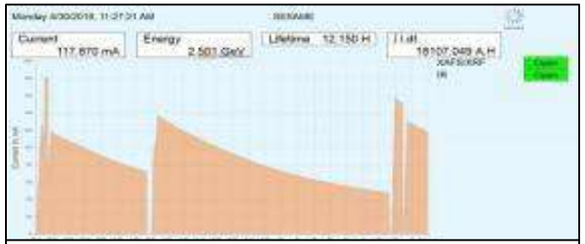
2016: Design

2017: Fabrication/France

2018: Installation

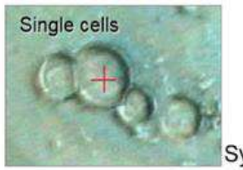
2018: Experimental Hutch

Alignment



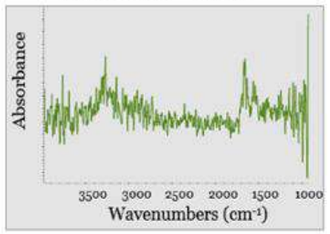
2018: SR-Commissioning

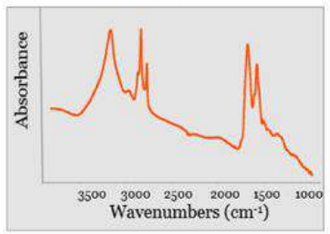
From Paul Dumas, SOLEIL



Globar: 6x6 μm²
1000 scans = 500s

Synchrotron: 6x6 μm²
32 scans = 16 s





DAY-1 Beamline

BEAMLINE SERVING SESAME USERS SINCE NOVEMBER 2018

1. BM02 - IR cont.

2022: New Microscope and Spectrometer installed in the Experimental Hutch as part of INFN-CHNet.

First Publication from the IR Beamline in Feb. 2020

Journal of Pharmaceutical and Biomedical Analysis 184 (2020) 113186

Contents lists available at ScienceDirect

Journal of Pharmaceutical and Biomedical Analysis

journal homepage: www.elsevier.com/locate/jpba

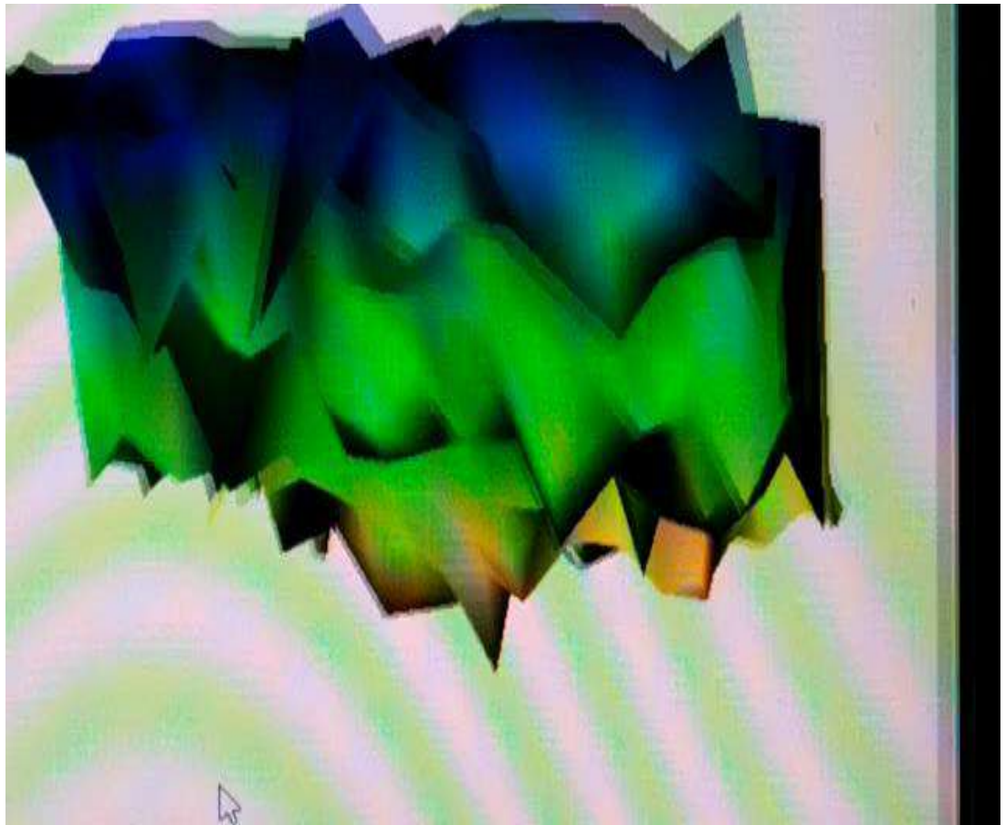
Investigating the molecular structure of placenta and plasma in pre-eclampsia by infrared microspectroscopy

Lina A. Dahabiyeh[a,*], Randa S.H. Mansour[b], Shawqi S. Saleh[c], Gihan Kamel[d,e]

[a] Department of Pharmaceutical Sciences, School of Pharmacy, The University of Jordan, Queen Rania St, Amman, 11942, Jordan
[b] Faculty of Pharmacy, Philadelphia University, 19392, Amman, Jordan
[c] Department of Obstetrics and Gynaecology, School of Medicine, The University of Jordan, 11942, Amman, Jordan
[d] SESAME Synchrotron (Synchrotron-light for Experimental Science and Applications in the Middle East), 19252, Allan, Jordan
[e] Department of Physics, Faculty of Science, Helwan University, Cairo, Egypt

“Analysis of Ancient Mummified Human Head Skin Using SR-IR Microspectroscopy”

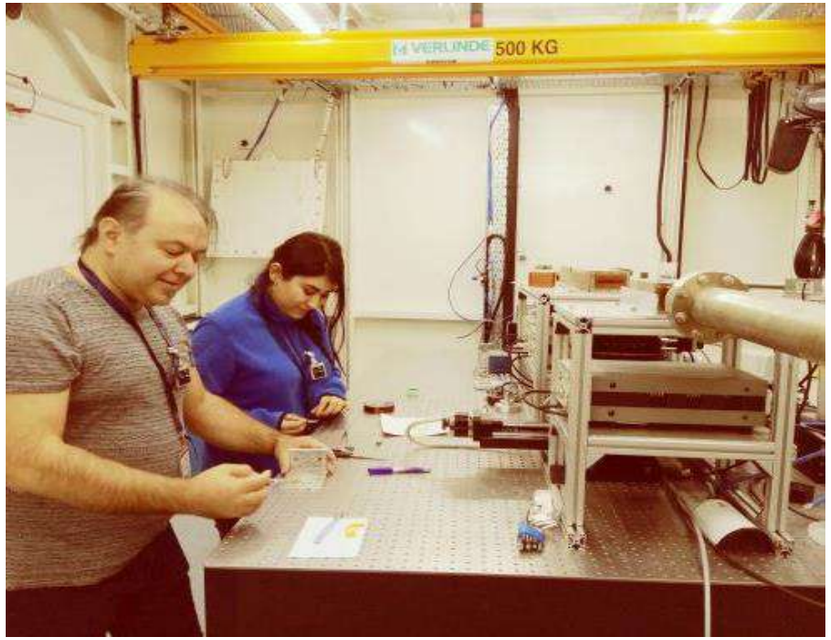
Despina Moissidou (Greece), Hayley Derricott (UK), Barts and the London Medical School (Malta)



2. BM08 - XAFS/XRF

The XAFS/XRF beamline is the first operational beamline at SESAME, and it has been open for external users since July 2018.

Ozensoy's team during a beamtime campaign (group of PhD students) from Bilkent University



Dr. Murat Osman Ozkendir and his MSc. student from Mersin University while changing samples

First Scientific Paper Published in June 2019 in a High Impact Factor Journal (11.6)

Applied Catalysis B: Environmental 256 (2019) 117808

Contents lists available at ScienceDirect

Applied Catalysis B: Environmental

journal homepage: www.elsevier.com/locate/apcatb

Exceptionally active and stable catalysts for CO_2 reforming of glycerol to syngas

Selin Bac[a], Zafer Say[b,c], Yusuf Kocak[b], Kerem E. Ercan[b], Messaoud Harfouche[d], Emrah Ozensoy[b,e,**], Ahmet K. Avci[a,*]

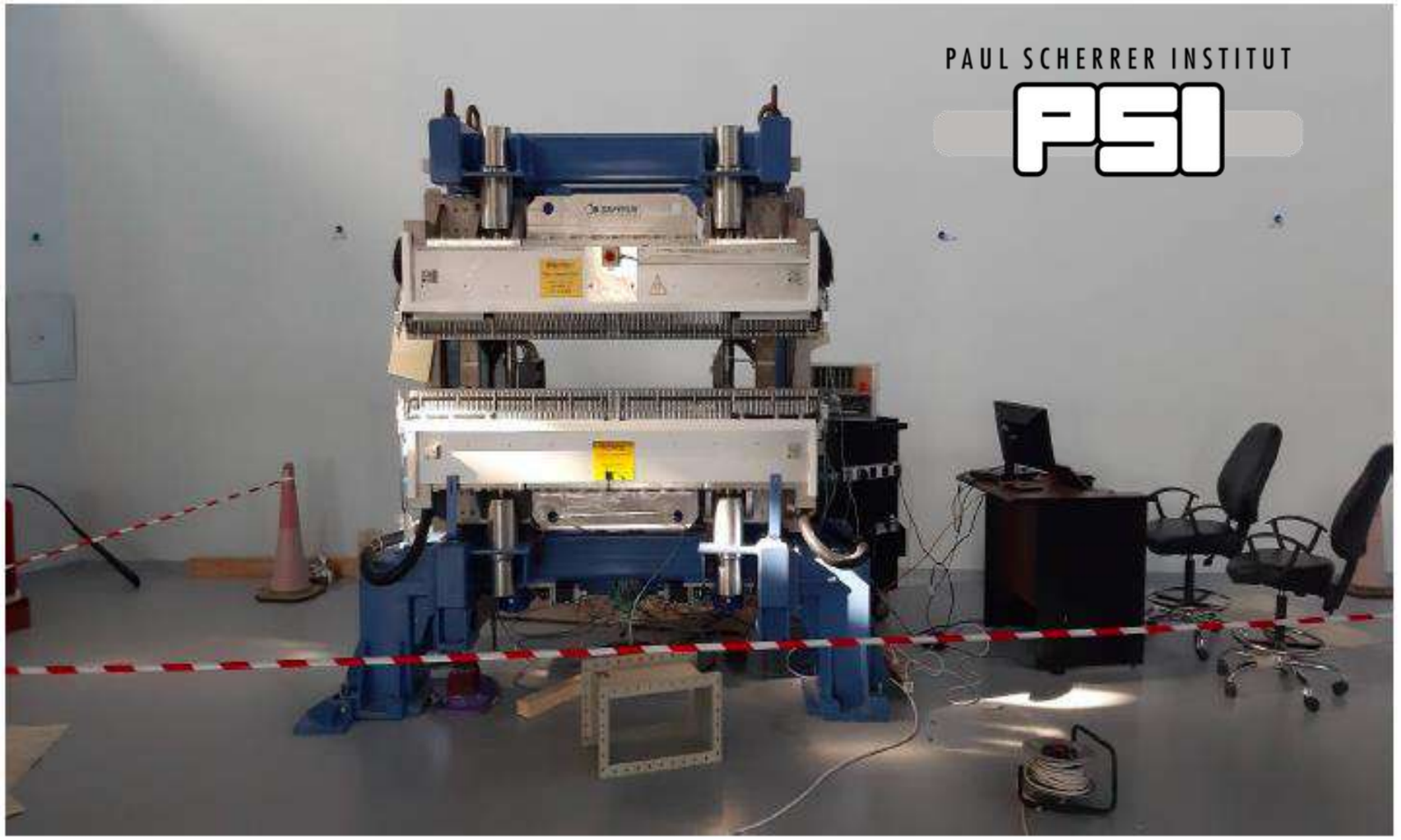
[a] Department of Chemical Engineering, Bogazici University, Bebek, 34342, Istanbul, Turkey
[b] Bilkent University, Department of Chemistry, 06800, Ankara, Turkey
[c] Department of Physics, Chalmers University of Technology, 412 96, Göteborg, Sweden
[d] Synchrotron-Light for Experimental Science and Applications in the Middle East (SESAME), 19252, Allan, Jordan
[e] UNAM-National Nanotechnology Center, Bilkent University, 06800, Ankara, Turkey

PAUL SCHERRER INSTITUT

PSI

3. ID09 - Materials Science X-ray Powder Diffraction

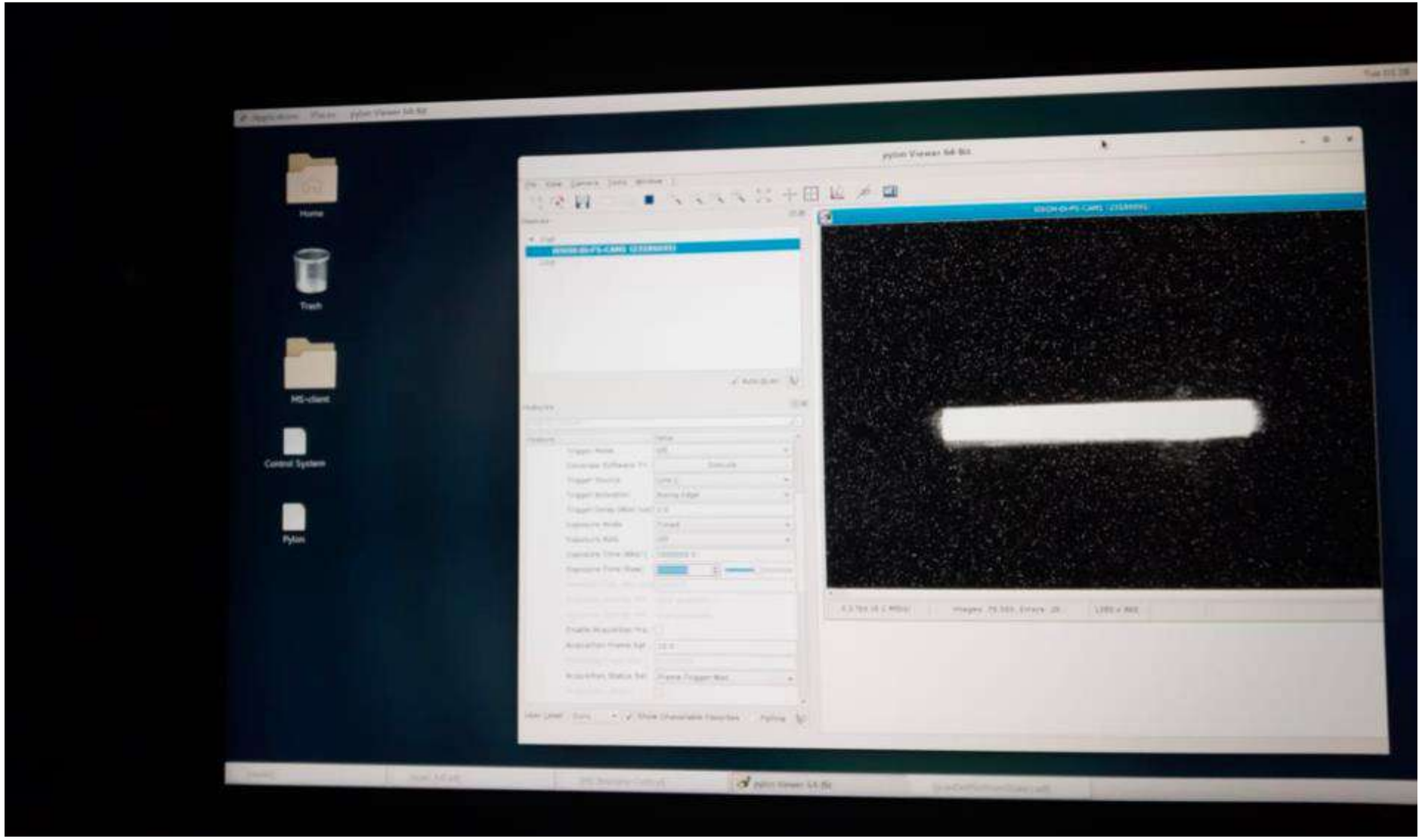
3. ID09 - Materials Science X-ray Powder Diffraction cont.



January 2019 - Wiggler source before installation and commissioning

3. ID09 - Materials Science X-ray Powder Diffraction cont.

3. ID09 - Materials Science X-ray Powder Diffraction cont.



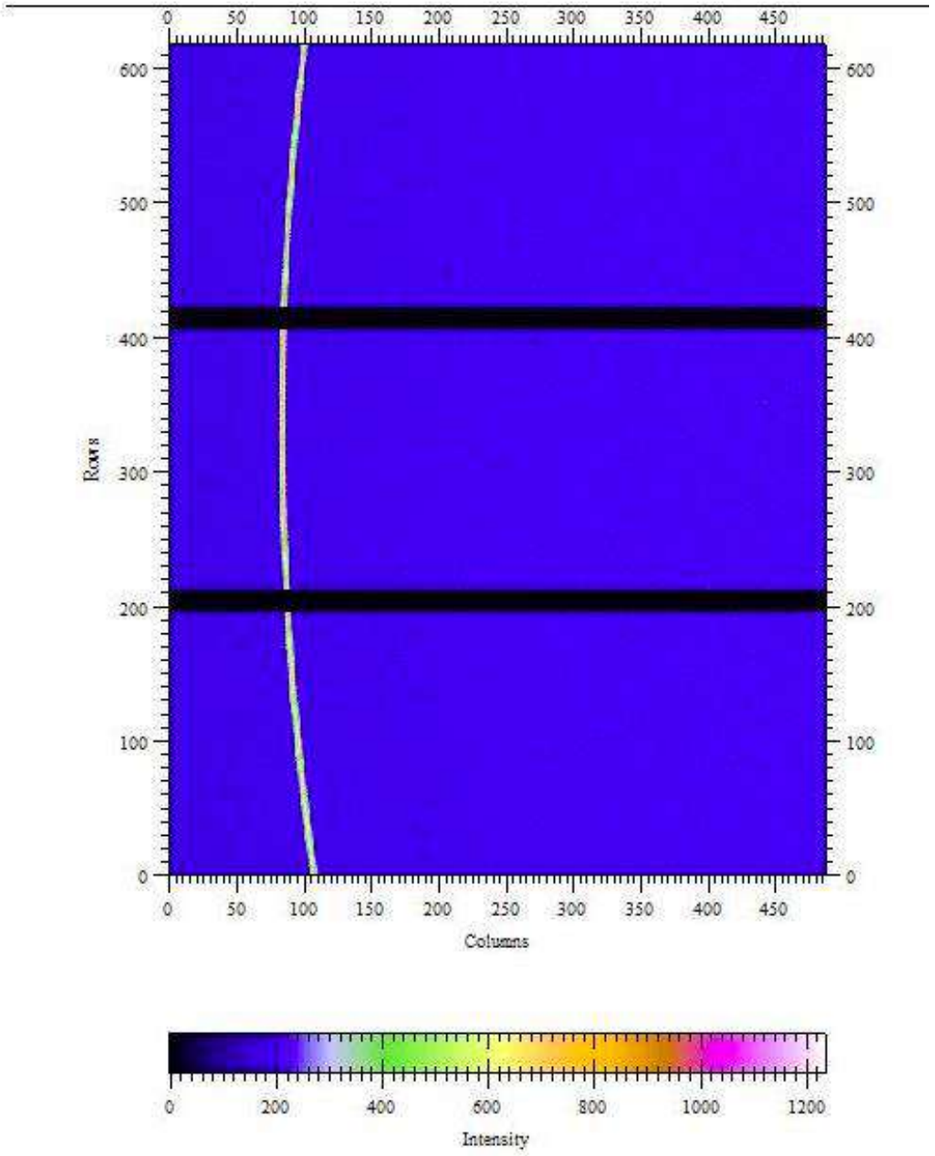
3. ID09 - Materials Science cont.

Spring-summer 2020:
Diffractometer refurbishment and installation

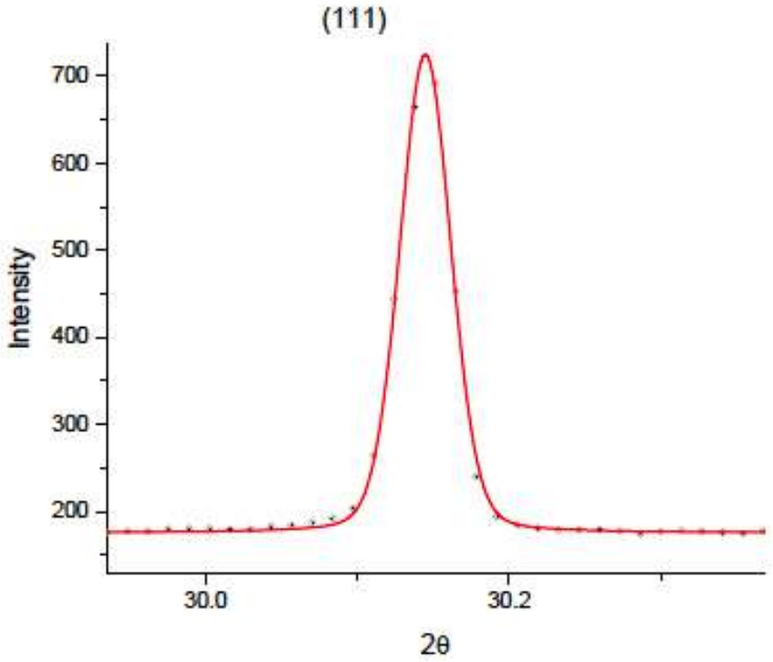
- **Adding XY sample stage**
- **Extending 2Theta (detector) arm**
- **Adding capillary spinner**
- **Adding 2Theta encoder**
- **Pre slits**
- **I_0 ionization chamber**
- **Filter**
- **Sample environment (High and Low T)**

External table support for more stability

3. ID09 - Materials Science cont.



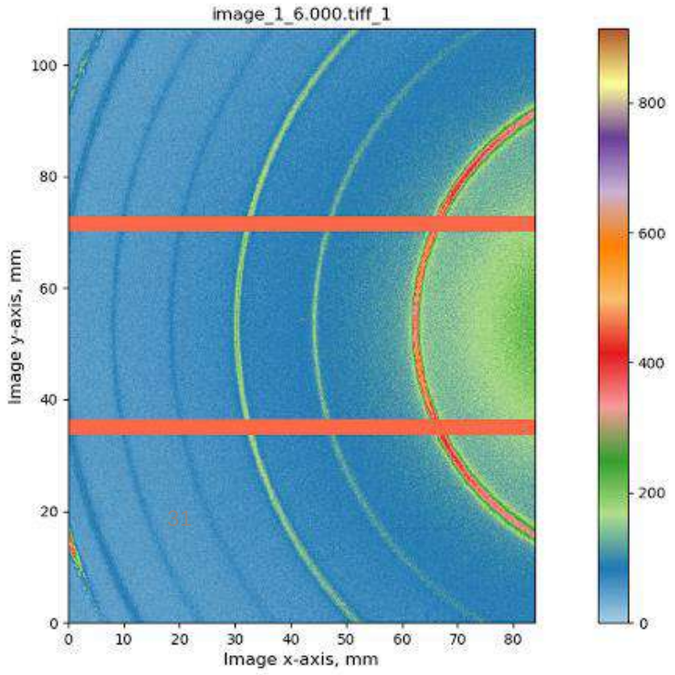
Oct. 22, 2020
First diffraction pattern measured
Silicon standard @ 8 keV



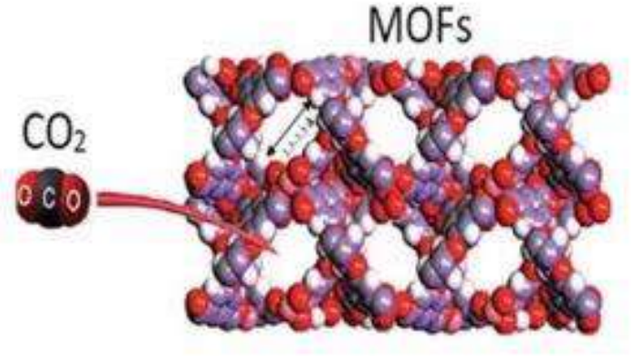
3. ID09 - Materials Science cont.

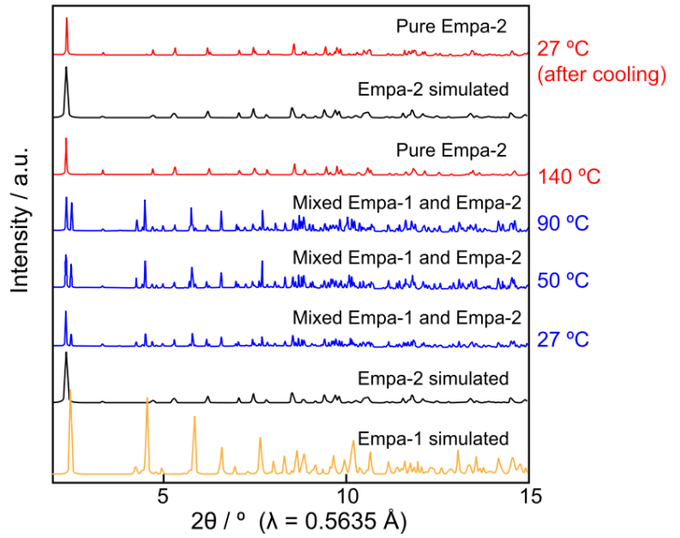
RSS research team (from left to right: Ala'a Al- Ghourani and Kyle Cordova) with Mahmoud Abdellatief from SESAME at the MS beamline control hutch.

Dec. 17, 2020: MS hosts its first users, a team from the Royal Scientific Society (RSS) for a research focused on the structural properties of novel highly-porous materials for use in mitigating the effects of climate change.



3. ID09 - Materials Science cont.



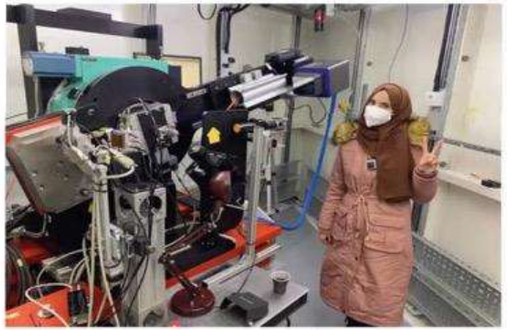


ACS MATERIALS LETTERS

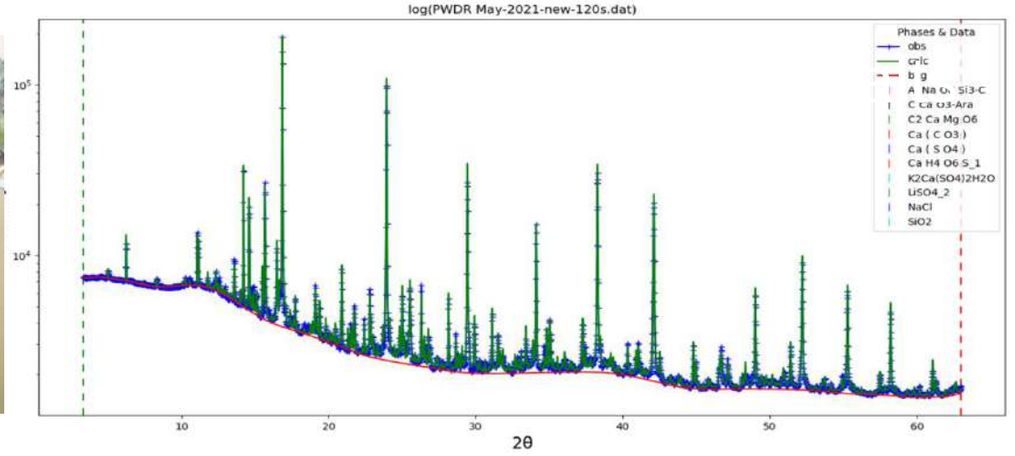
www.acsmaterialsletters.org

Robust Barium Phosphonate Metal–Organic Frameworks Synthesized under Aqueous Conditions

Khalifah A. Salmeia,* Simone Dolabella,‡ Dambarudhar Parida,‡ Terry J. Frankcombe, Akef T. Afaneh, Kyle E. Cordova, Bassem Al-Maythalony, Shanyu Zhao, Romain Civioc, Ali Marashdeh, Bernhard Spingler, Ruggero Frison, and Antonia Neels*



3. ID09 - Materials Science cont.



PNAS RESEARCH ARTICLE | CHEMISTRY OPEN ACCESS

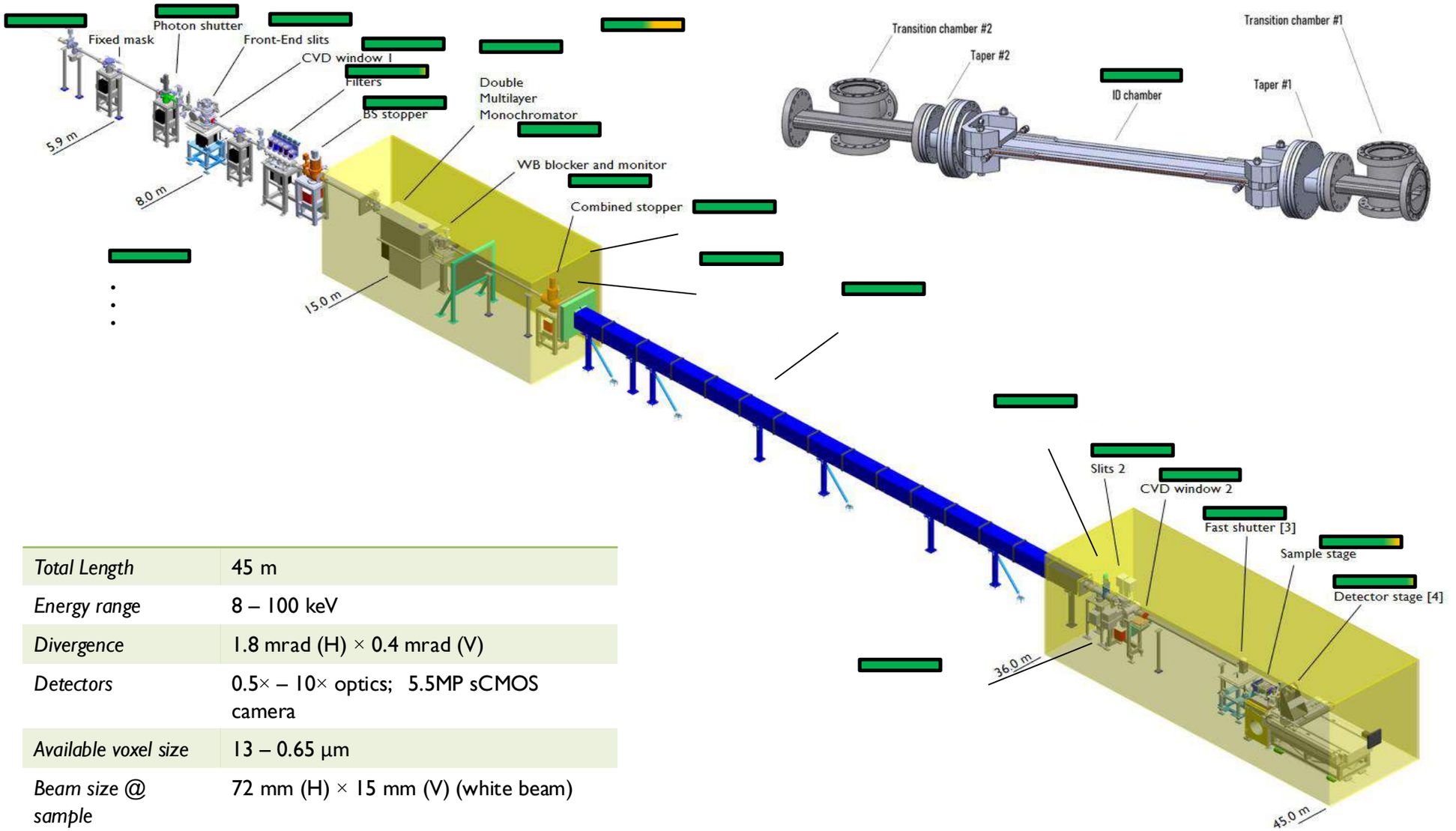
Harvesting of aerial humidity with natural hygroscopic salt excretions

Marieh B. Al-Handawi [a], Patrick Commins [a], Robert E. Dinnebier[b], Mahmoud Abdellatief[c], Liang Li[a,d,1], and Panče Naumov [a,e,f,g,1]

4. ID10 - Beamline for Tomography at SESAME (BEATS)

- The project is an H2020-EU funded project of €6.0 million to pave the way for an efficient and sustainable operation of SESAME.
- Led by the ESRF, the European synchrotron (France), BEATS involves leading research facilities in the Middle East (SESAME and the Cyprus Institute), and European synchrotron radiation facilities ALBA-CELLS (Spain), DESY (Germany), the ESRF (France), Elettra (Italy), INFN (Italy), PSI (Switzerland), SESAME (Jordan) and SOLARIS (Poland).
- Aimed at serving user communities in the region, in particular the cultural heritage and archaeology communities. It is an obvious advantage for these communities to be able to access a state-of-the-art beamline close to the source of samples or remains to be analyzed.

4. ID10 - BEATS cont.



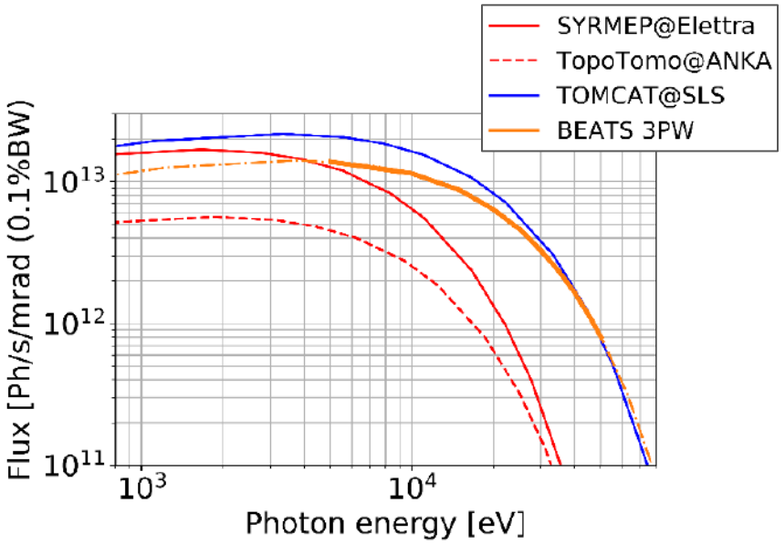
Total Length	45 m
Energy range	8 – 100 keV
Divergence	1.8 mrad (H) × 0.4 mrad (V)
Detectors	0.5× – 10× optics; 5.5MP sCMOS camera
Available voxel size	13 – 0.65 µm
Beam size @ sample	72 mm (H) × 15 mm (V) (white beam)
Modalities	• Filtered white beam • Monochromatic (with DMM)

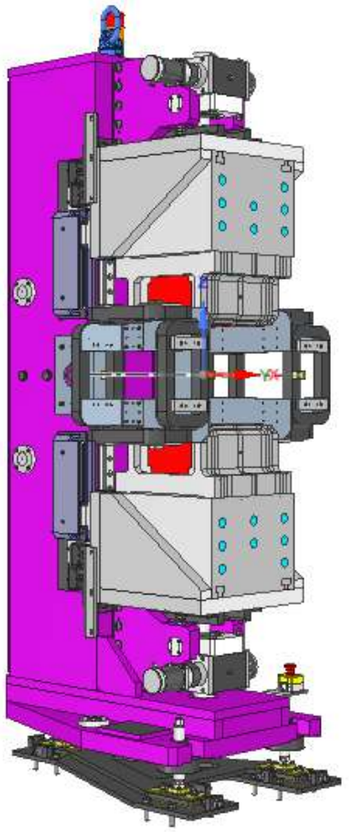
4. ID10 - BEATS cont.

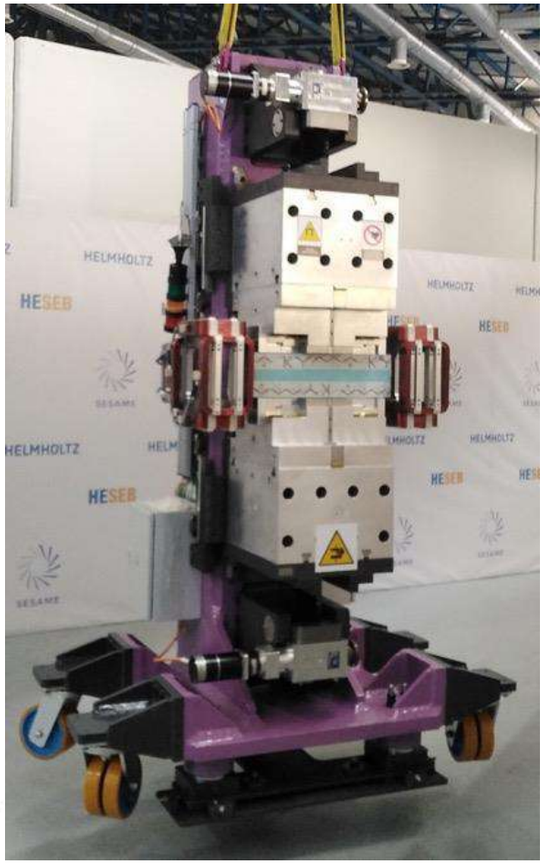
BEATS X-Ray source

3-pole wiggler

- Minimum gap: 11 mm ✓
- Maximum field: 2.92 T ✓
- Magnetic length: 0.41 m ✓



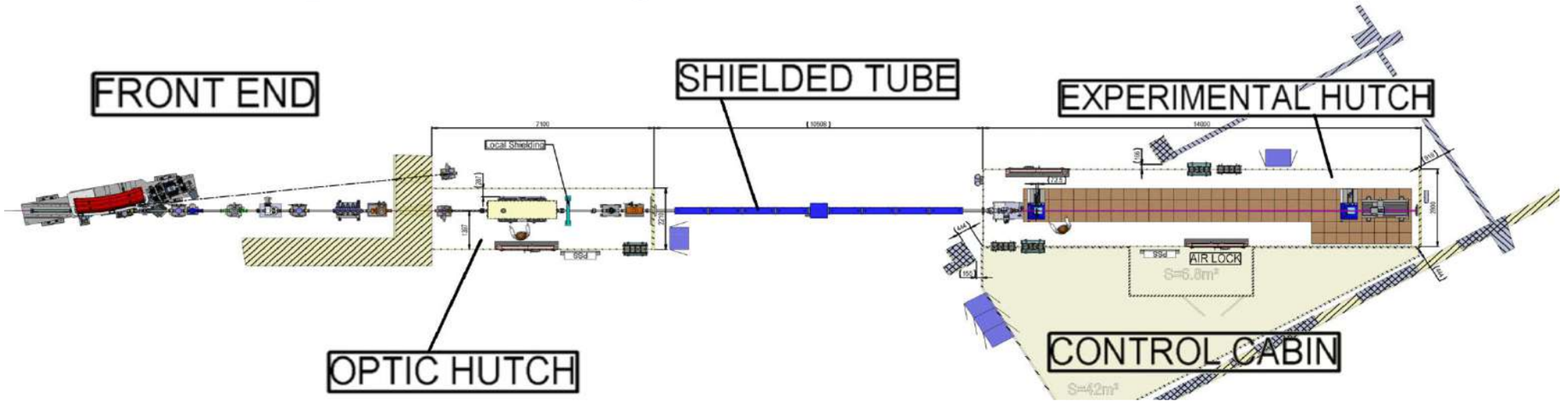


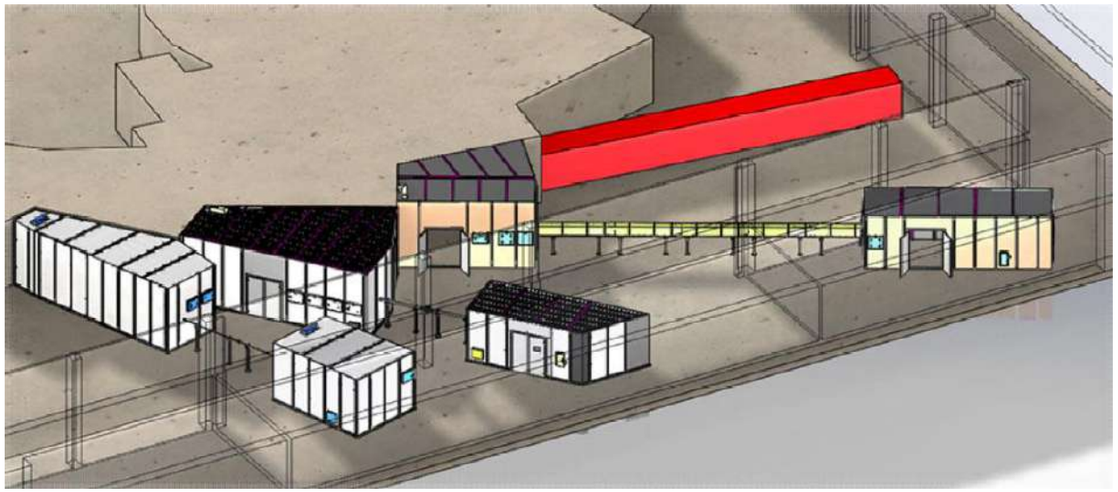


ALBA · The Cyprus Institute · DESY. · Elettra Sincrotrone Trieste · ESRF · INFN · PSI · SESAME · SOLARIS

4. ID10 - BEATS cont.

Longest beamline in SESAME,
required building modifications

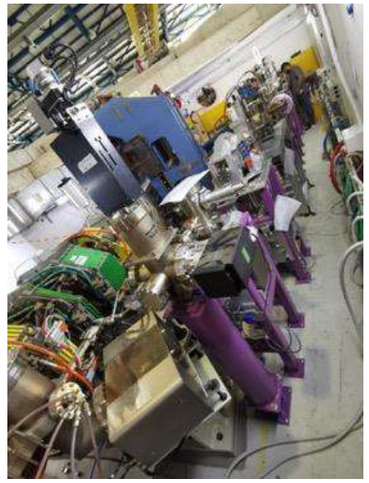




4. ID10 - BEATS cont.

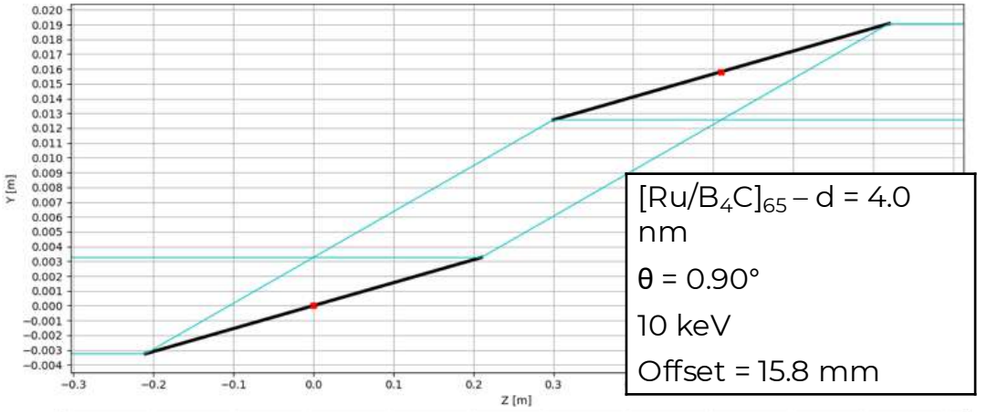
Hutches installation completed Feb. 2022

4. ID10 - BEATS cont.



AUGUST-SEPTEMBER 2022 shutdown
ID and front-end installation

4. ID10 - BEATS cont.

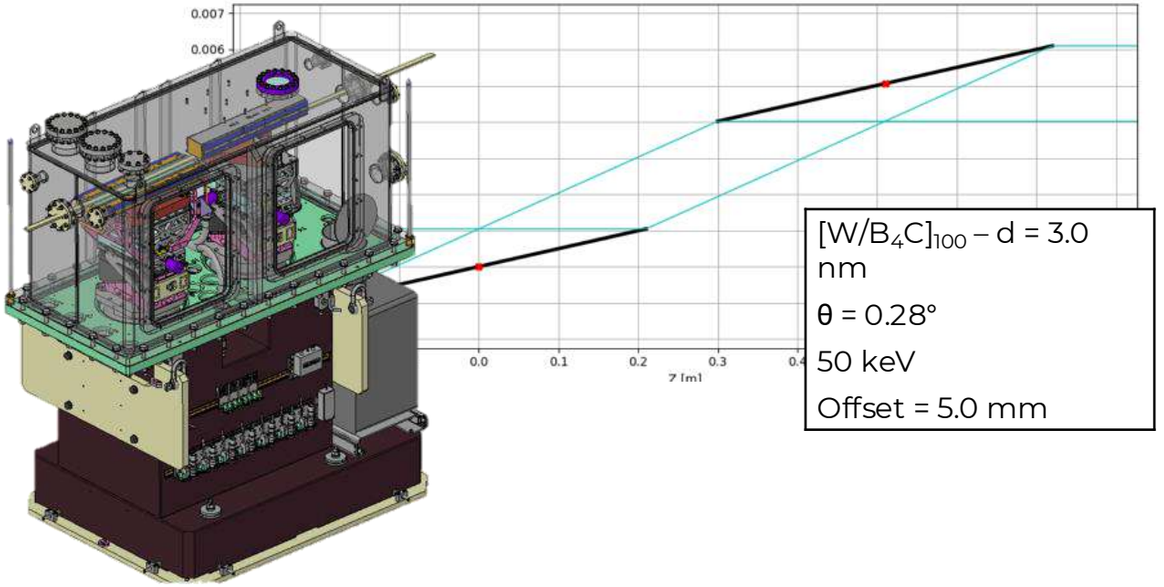


$[Ru/B_4C]_{65}$ – d = 4.0 nm

θ = 0.90°

10 keV

Offset = 15.8 mm



$[W/B_4C]_{100}$ – d = 3.0 nm

θ = 0.28°

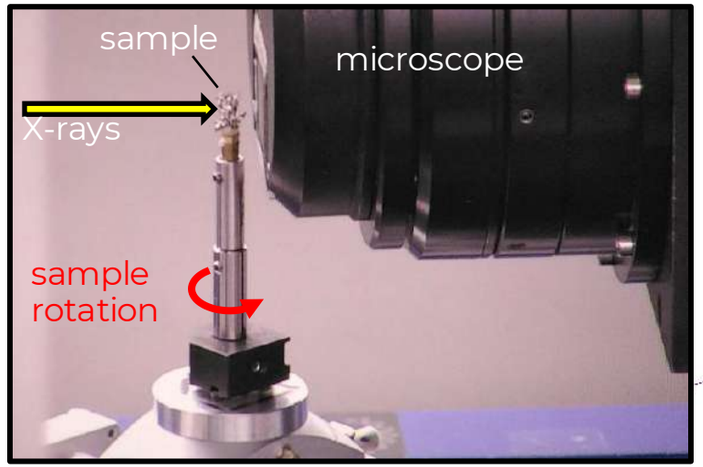
50 keV

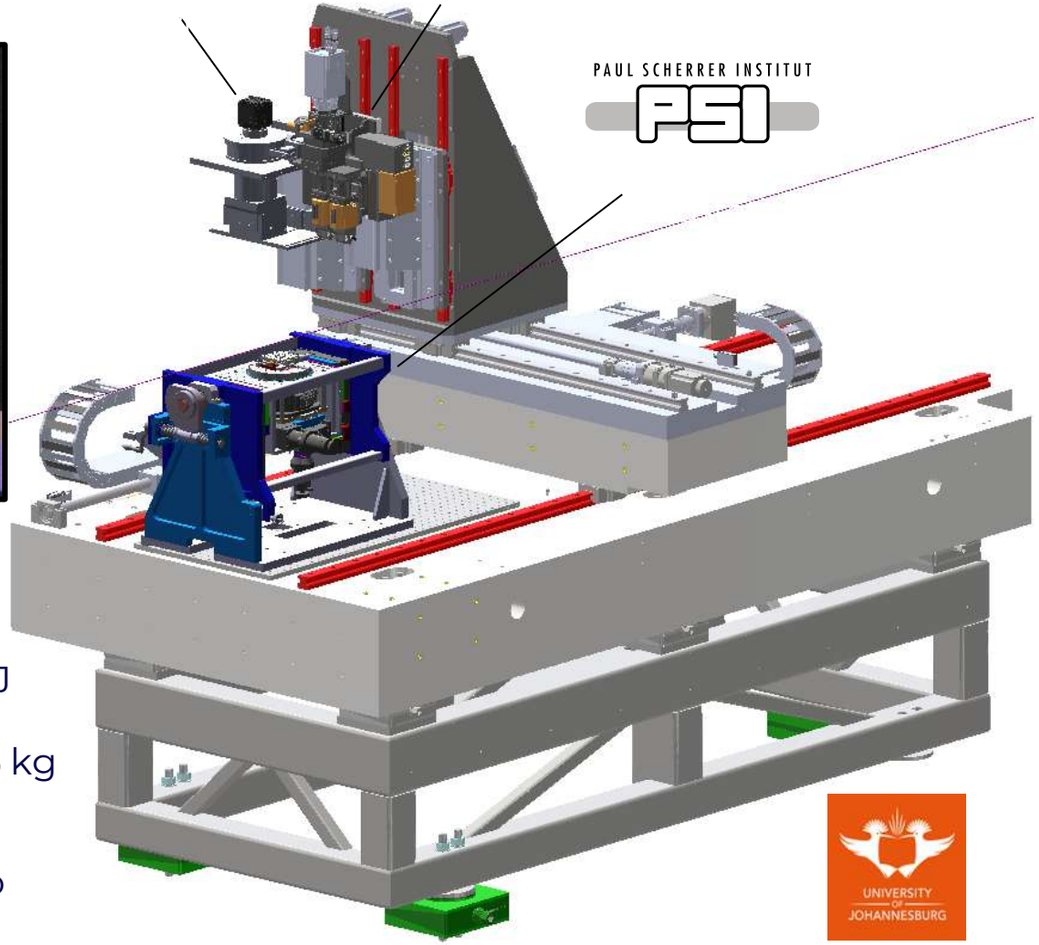
Offset = 5.0 mm

December 2022 / January 2023
Double Multilayer Monochromator (DMM) installed and under vacuum

4. ID10 - BEATS cont.

BEATS experimental station
Sample and detectors stage





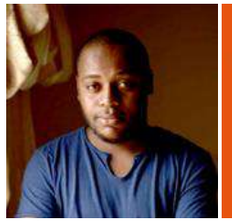
- Synergy with PSI TOMCAT, ESRF BM5 and UJ Johannesburg
- Micos air-bearing rotator for samples up to 5 kg
- Support for 2 detectors

- 1st eigenmode of granite stage maximized to minimize the effect of vibrations on the detectors

4. ID10 - BEATS cont.

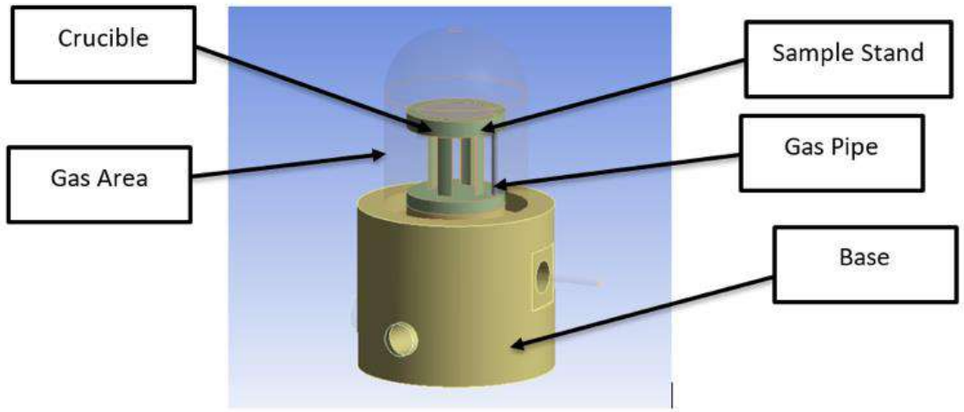
BEATS - Sample environment for in-situ studies

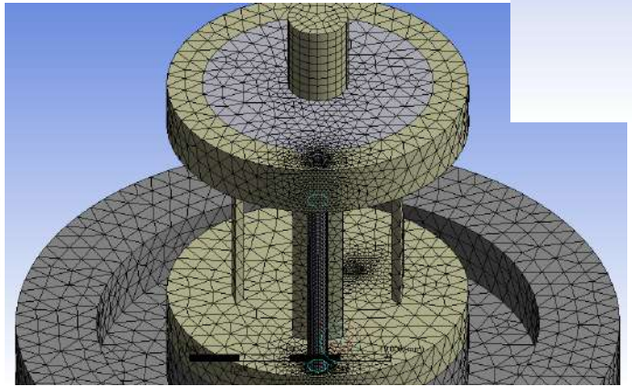
Sample furnace – Induction heating

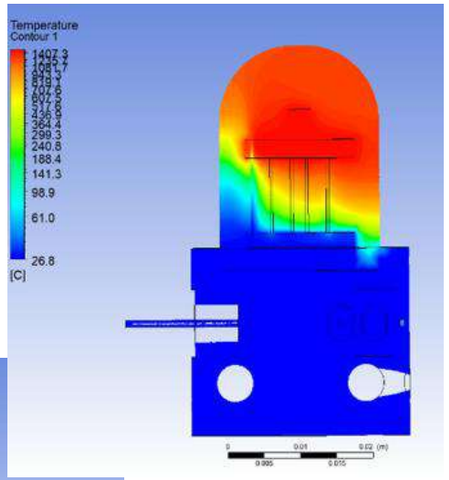


Fortune Mokoena

- Design optimization:
  - Crucible architecture
  - Temperature control and convection regime around sample
  - Isolation of slip ring and sensitive equipment
  - Simulate different sample materials and sizes
  - Predict cooling flow rate for experiments at the beamline





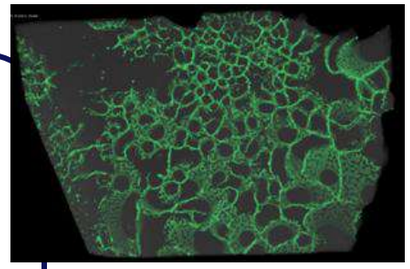


[F. Mokoena, M.Sc. thesis]

4. ID10 - BEATS cont.

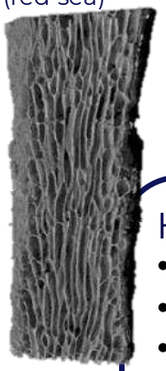
Synchrotron Tomography @ BEATS

Archaeology and Cultural Heritage
- Archaeological Materials
- Human bio-archaeology
- Plant remains
- Animal remains and artifacts

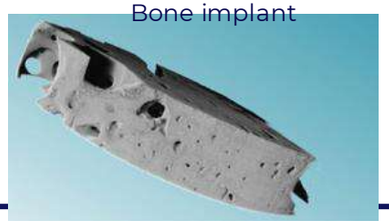


Roman glass

Mineralized algae (red sea)

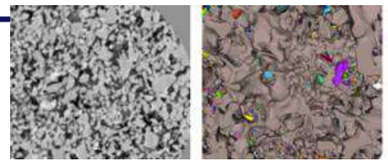


Bone implant

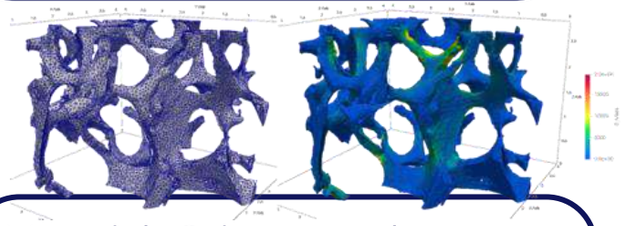


Health, Biology and Food
- Musculoskeletal research
- Bone and dental implants
- Soft tissue imaging
- Animal and plant characterization
- Food science

Agriculture and Environment
- Simulation of rock properties
- Soil characterization
- Sustainable agriculture



Sandstone core



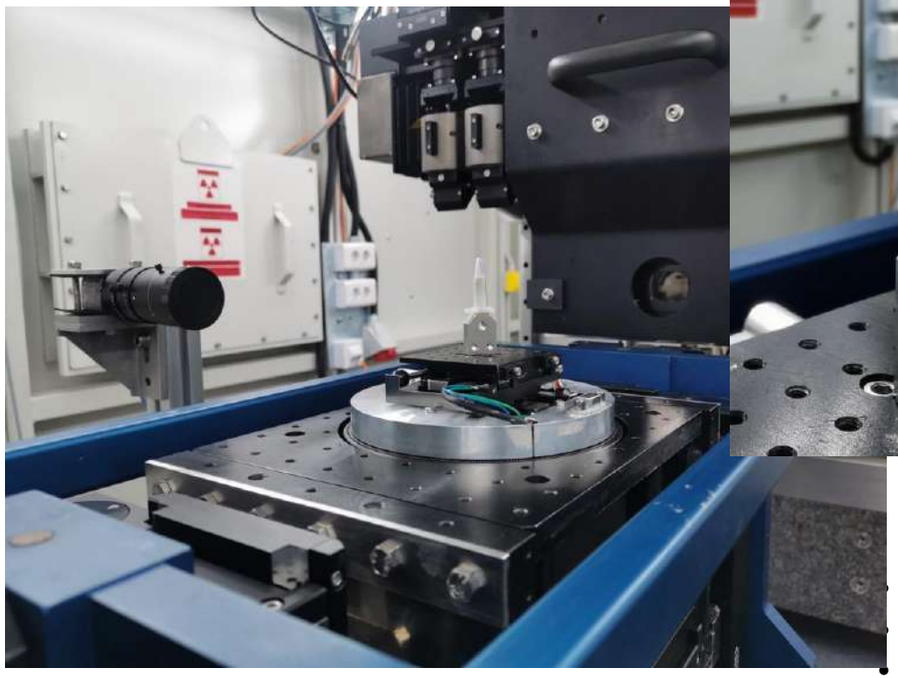
Materials Science and Engineering
- Light materials and alloys
- Materials under mechanical stress
- Energy materials research

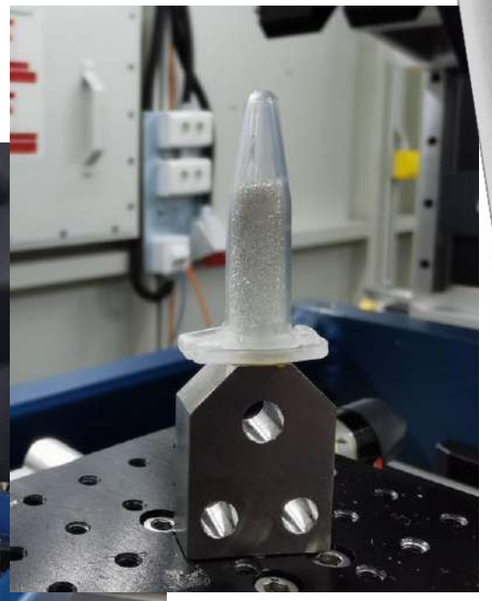
Services to Industry and Private Sector

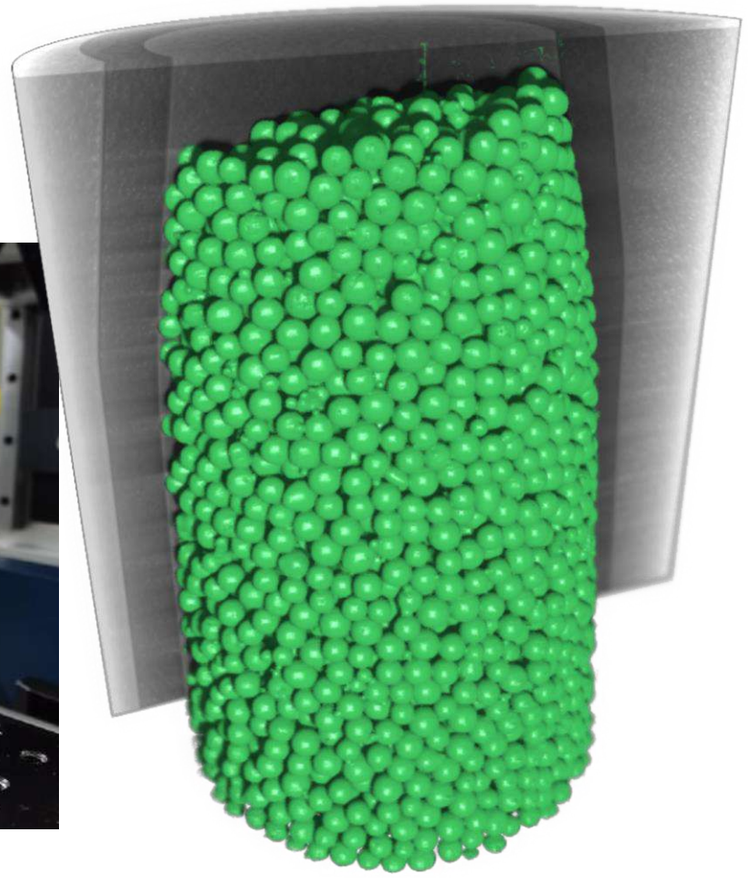
BEATS scientific case

4. ID10 - BEATS cont.

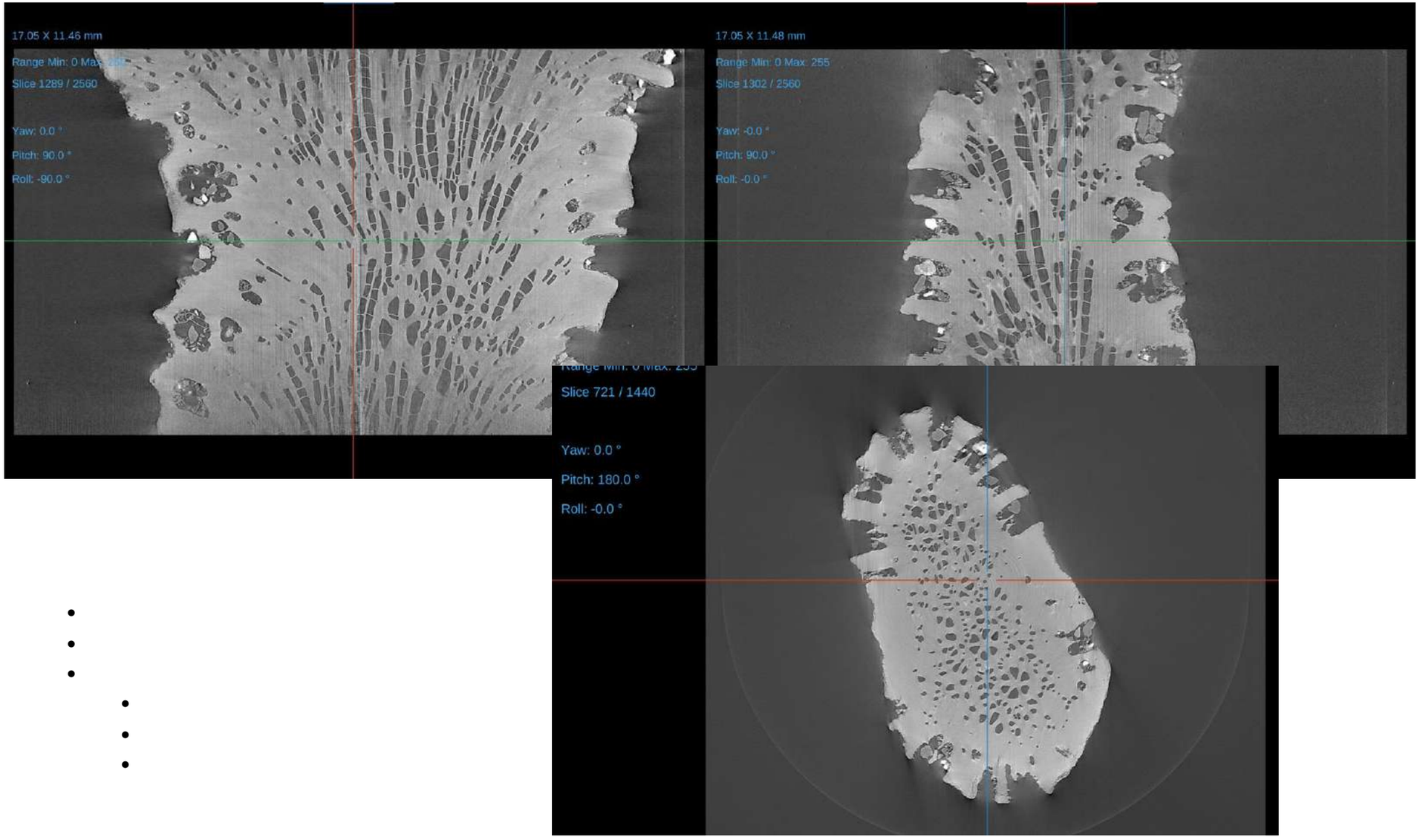
11 May 2023 – First BEATS scan







4. ID10 - BEATS cont.



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4. ID10 - BEATS cont.

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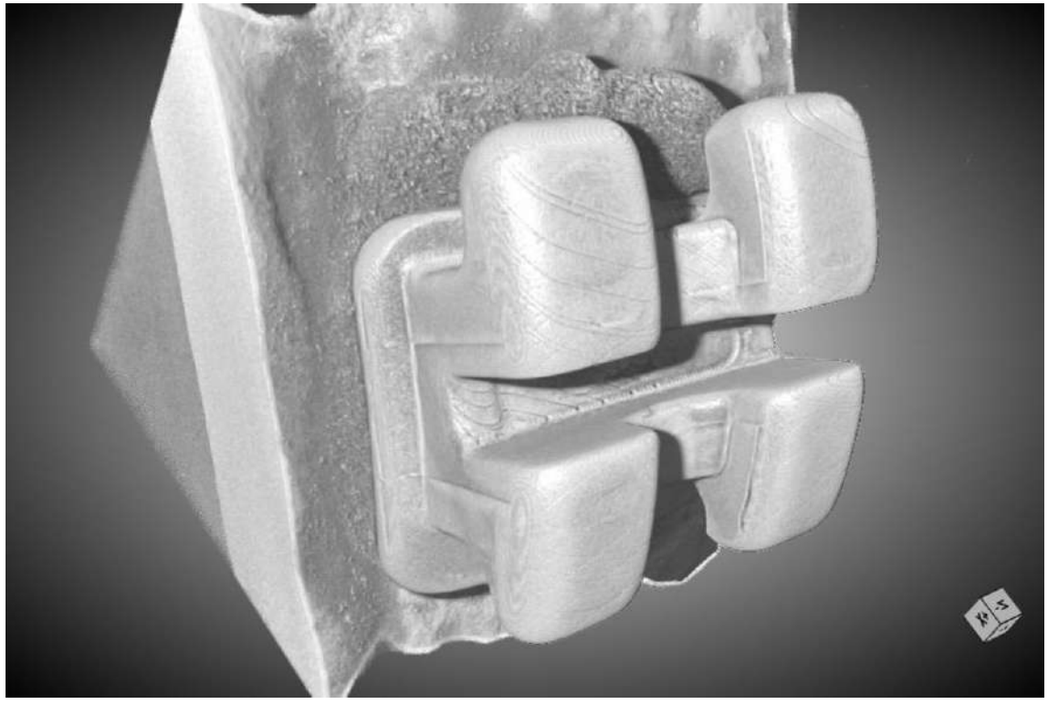
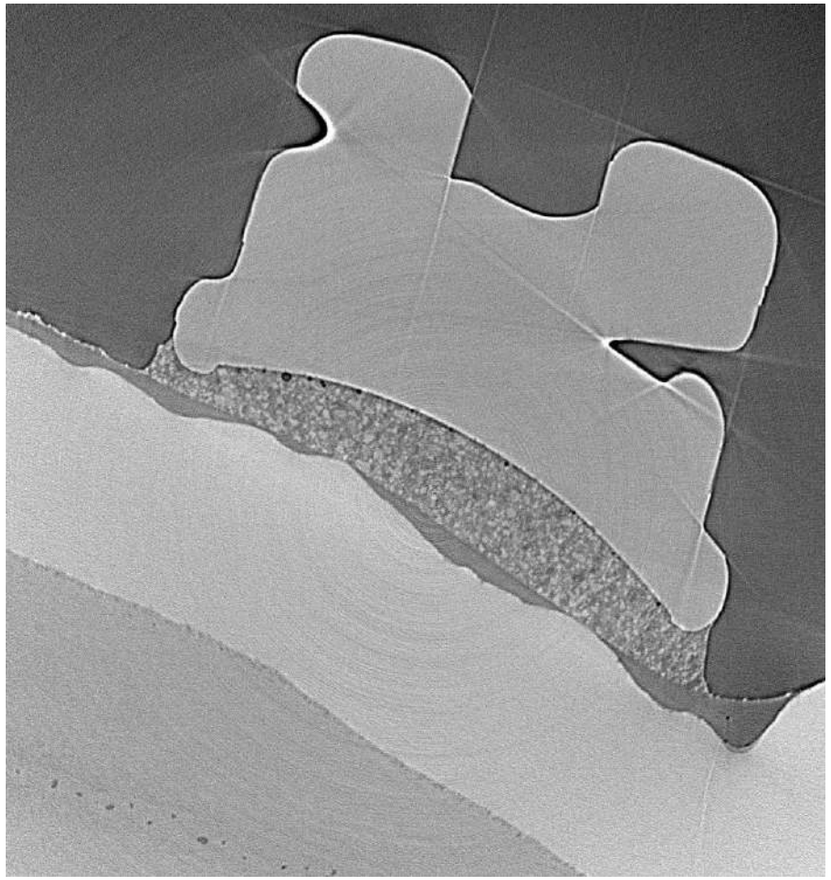
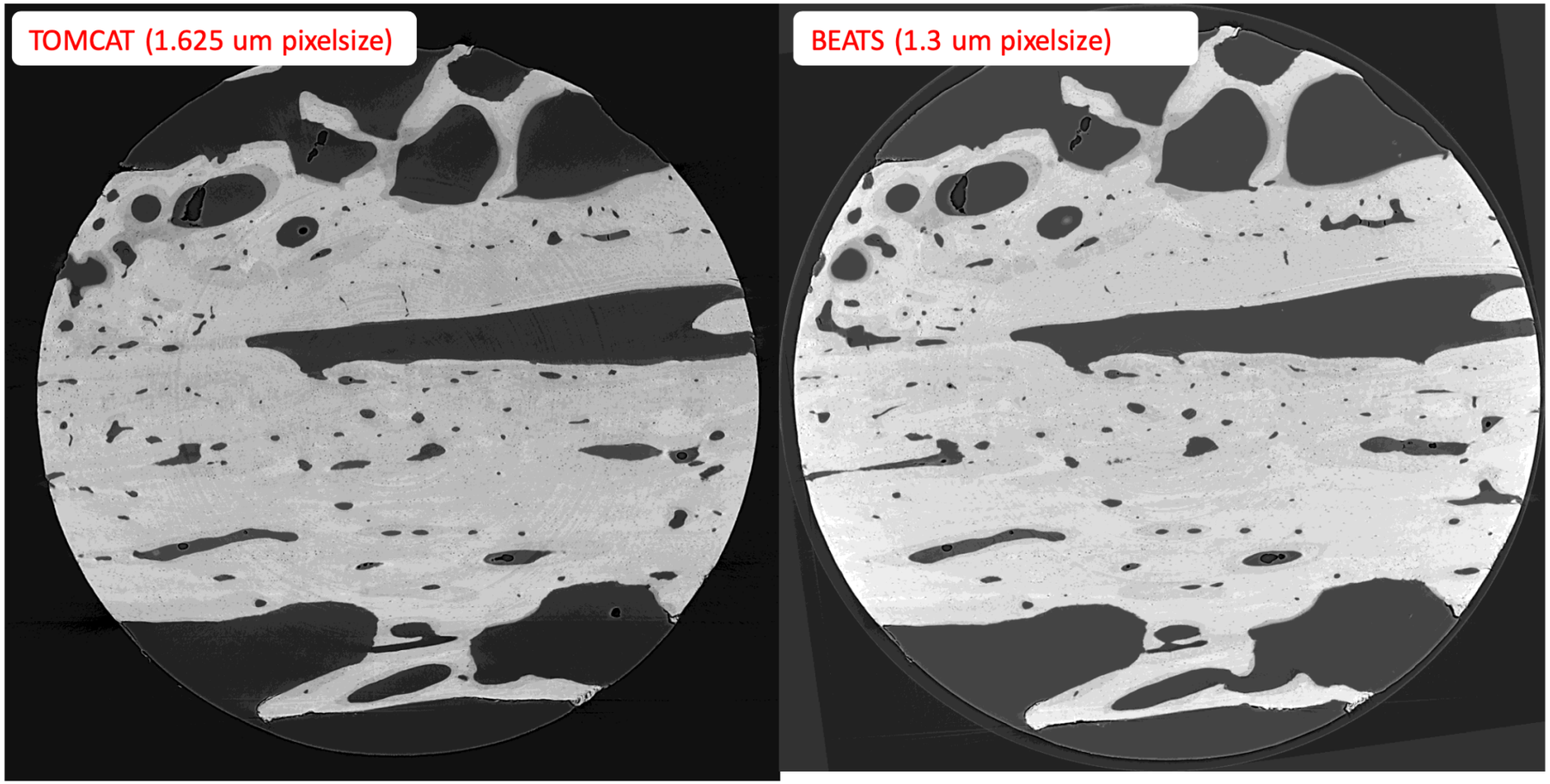




4. ID10 - BEATS cont.

- Sample: human bone (implant);



BEATS: Comparison BEATS – PSI TOMCAT

4. ID10 - BEATS cont.

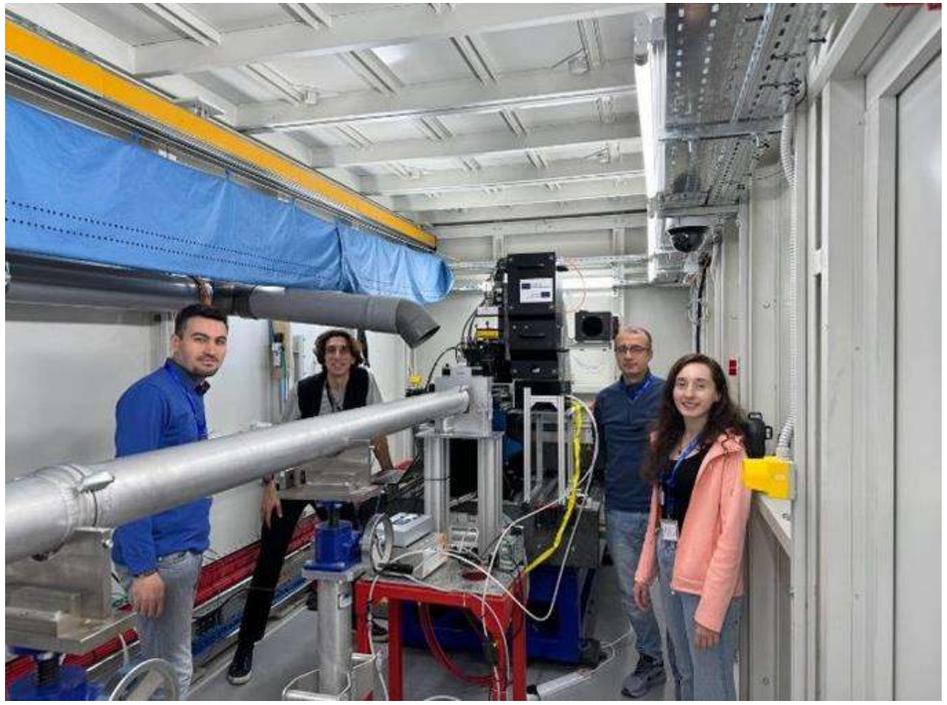
4. ID10 - BEATS cont.

11 February 2023 – First users at BEATS

Bilkent University UNAM (National Nanotechnology Research Center), Ankara, Türkiye

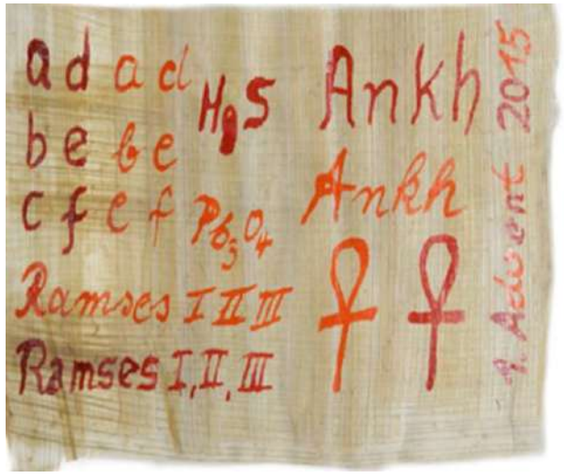
- Dr. Ali Karatutlu (Principal Investigator)
- Dr. Bülend Ortaç
- Ms. Zehra Gizem Mutlay (PhD Student)

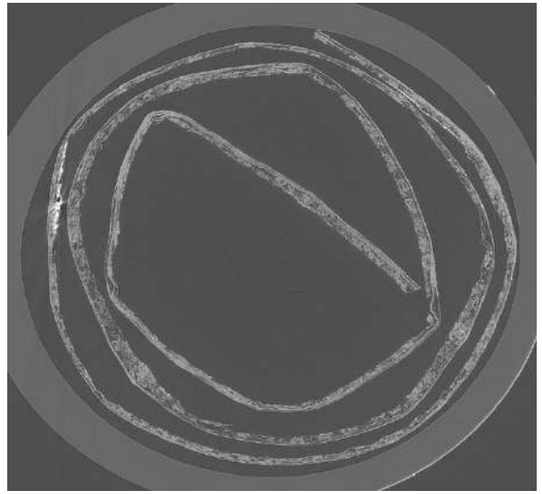
Nanotechnology, Fiber laser research



The measurements lasted three days, resulting in almost 500 Gigabytes of data, containing 3D pictures of different samples with a voxel size of 650 nanometers. These images provide insights into the manufacturing and applications of polarization-maintaining fiber glass products.

4. ID10 - BEATS cont.





Absorption edge sensitive tomography
Pb_3O_4 and HgS

Proposal # 20235045 (Ägyptisches Museum und Papyrussammlung Berlin, HZB, FU) Heinz-Eberhard Mahnke et al., Gianluca Iori, Philipp Hans

5. ID11L - HESEB
(Helmholtz-SESAME Beamline)

On 25th of October 2018, SESAME hosted a delegation from the Helmholtz Association of German Research Centers consisting of 43 persons. It was headed by Professor Otmar Wiestler, President of the Association.

During the visit, Otmar Wiestler informed SESAME that five research centers of the Helmholtz Association will be taking part in construction of a soft X-ray beamline for SESAME under the leadership of DESY (Deutsches Elektronen-Synchrotron). This is another one of SESAME's Phase I beamlines.

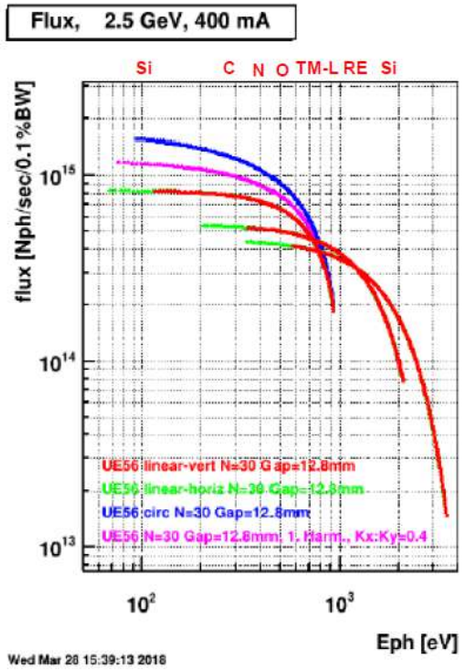
5. ID11L - HESEB cont.

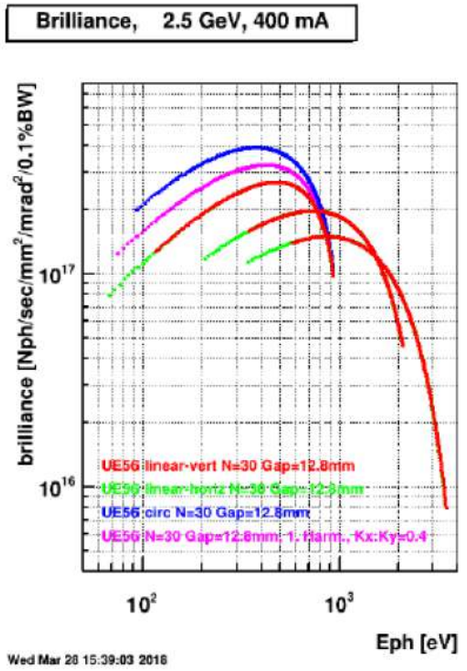
The five research centers are:

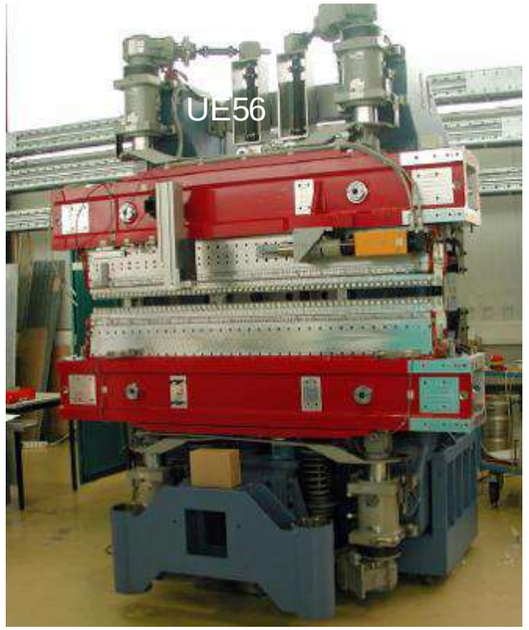
- **DESY (Deutsches Elektronen-Synchrotron)**
- **FZJ (Forschungszentrum Jülich)**
- **HZB (Helmholtz-Zentrum Berlin)**
- **HZDR (Helmholtz-Zentrum Dresden-Rossendorf)**
- **KIT (Karlsruher Institut für Technologie)**

A complete undulator beamline with monochromator and refocusing optics and a small chamber to conduct absorption and fluorescence yield experiments. The capital value of this beamline is €3.5 million

5. ID11L - HESEB cont.







ID-Chamber produced
at SAES / IT now at SESAME

Covers the core edges:

- Si L-edge—semiconductors
- C-, N-, O- Kedge - Organics catalysis
- TM-L-edges magnetics
- RE 3d edges magnetics
- Al- K-edge, Si-K-edge

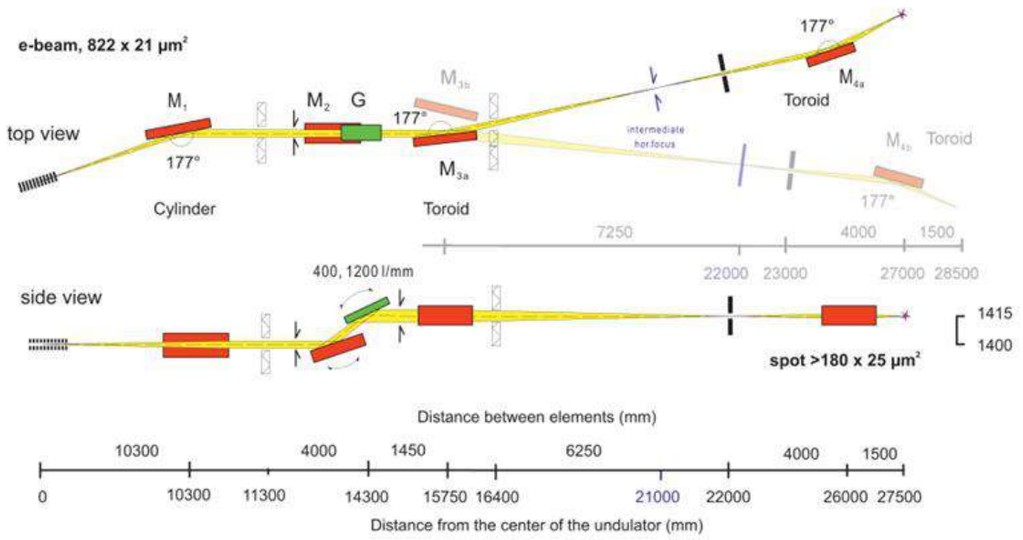
In a nutshell:

- ID chamber, tapered chambers
- Refurbishment of UE56 at HZB
- Training visit of 4 SESAME staff to HZB in August 2021
- Installed at SESAME in April 2022

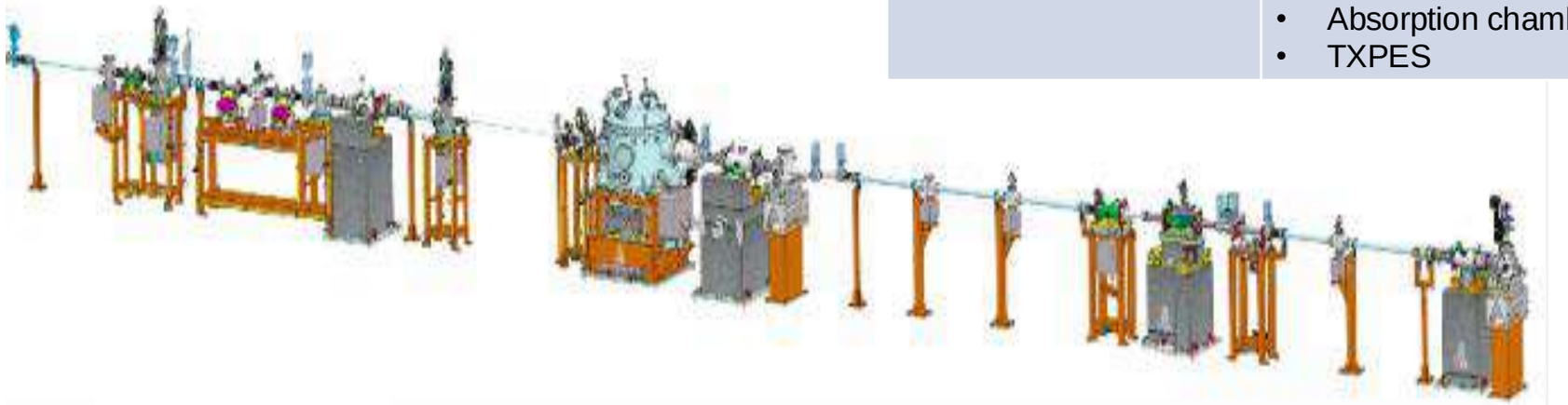
HZB - Undulator UE56 (APPLE II) with variable polarization

5. ID11L - HESEB cont.

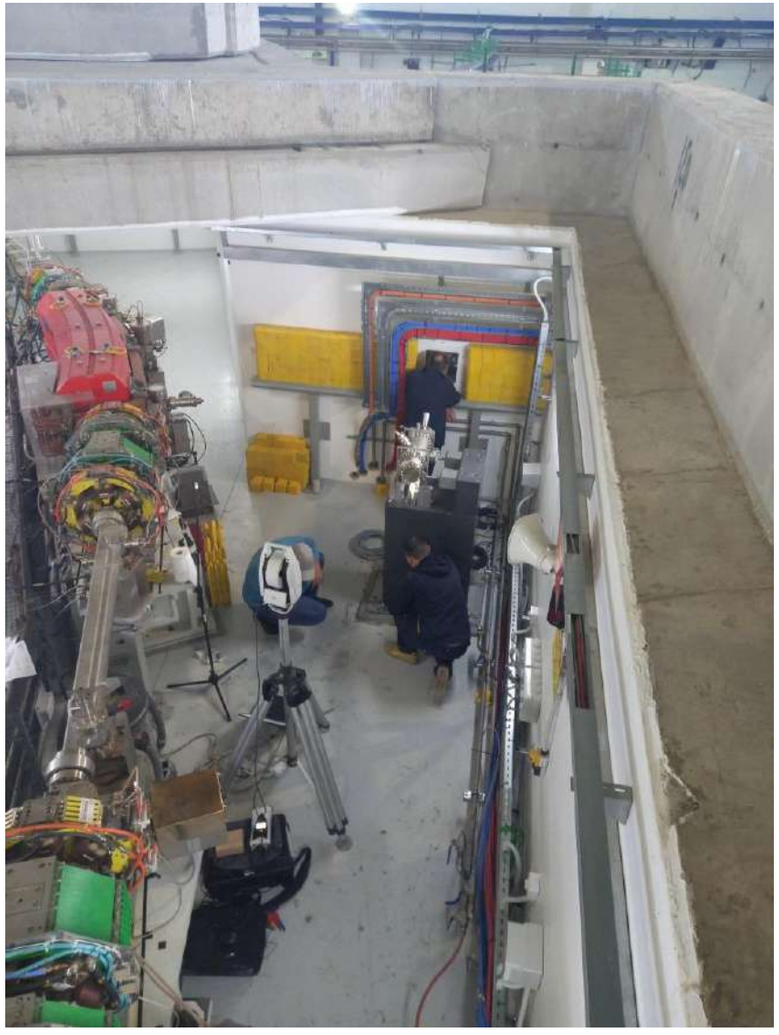
Optics concept /parameters



Parameter	Value
Undulator	UE56, APPLE II, Length: 1,7m, Period: 56mm
Polarization modes	Linear / circular
E_Photon range	~90 – 2000 eV
Photon flux on sample	1E12 1/s
Monochromator	Collimated plane-grating monochromator PGM (BESSY design)
Spot size on sample	180 (h) x 25 (v) um
Branches	Two: • Absorption chamber • TXPES



5. ID11L - HESEB cont.

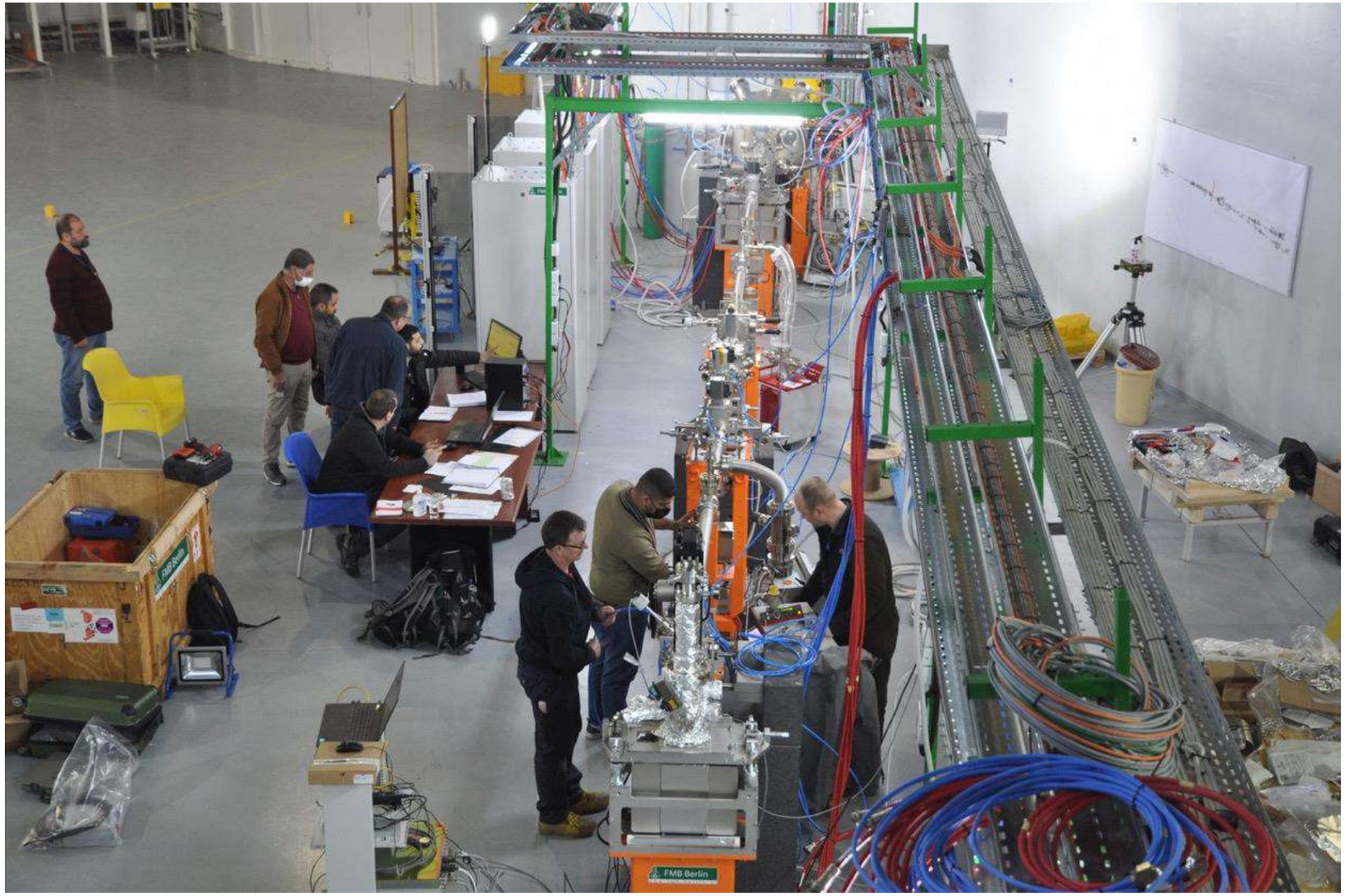


January 2022: Installation of the Beamline and the Front End

5. ID11 - HESEB cont.

January 2022: Final Stage of Installation

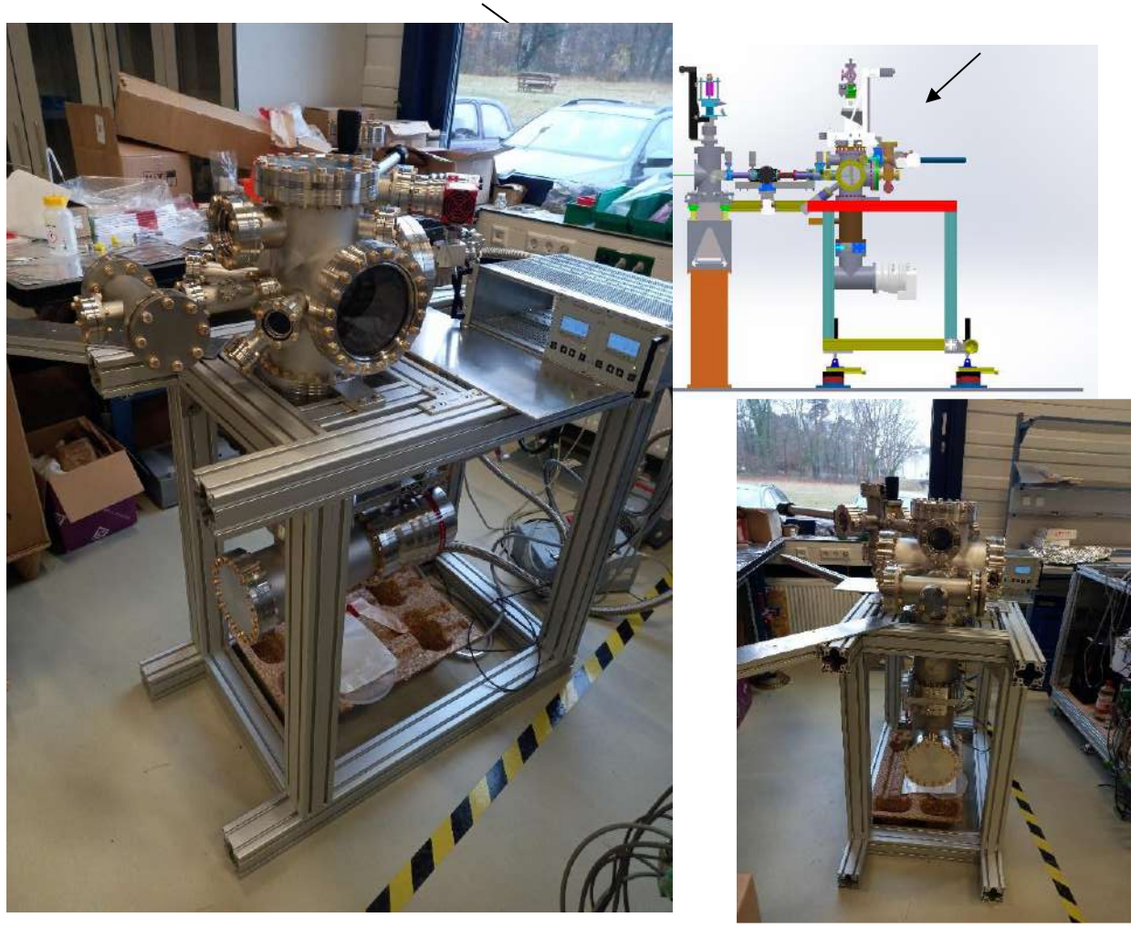
5. ID11 - HESEB cont.



January 2022: Beamline Leak Test + Controls Tuning

5. ID11 - HESEB cont.

- Design led by W. Eberhardt / M. Genisel
- Absorption, CMXD and fluorescence yield studies
- Manipulator arm with sample transfer heating/cooling (FZ Jülich)
- Assembly for focussing capillary (TU-Berlin) has been designed and built
- 2D-mapping of surfaces with 20 μm spatial resolution UHV---up to pressures of 1 atmosphere (He)



HESEB Experimental Chamber

5. ID11 - HESEB cont.

June 8, 2022: First Beam in HESEB Beamline

5. ID11 - HESEB cont.

- H.E. Prof. Wajih Owais, Minister of Higher Education and Scientific Research of Jordan

- Professor Otmar Wiestler, President of the Helmholtz Association of German Research Centres

- H.E. Mr. Bernhard Kampmann, Ambassador of Germany to Jordan

June 12, 2022: Official Inauguration

5. ID11 - HESEB cont.

Characterisation and Conservation of Paintings on Walls and Sculpture from Nabataean Petra

B. Kanngiesser and M. Naes

Berlin Laboratory for innovative X-ray Technologies

- Analytical Investigations of wall paintings and sculpture: in-situ and ex-situ; organic and inorganic, non-invasive & ND
- Development of experimental conservation material for gold: synthesis, characterisation, validation, evaluation

Gold

Lead, Copper

5. ID11 - HESEB cont.

HESEB User community building

In the original proposal we prepared/planned various teaming/twinning actions for 2020, incl. a major workshop in March 2020 in Turkey

However, had to cancel all this due to SARS-CoV2

In 2020/2021 several HESEB online seminars/ workshops were organized

We also make use of synergies with BEATS, i.e. close coordination, joint events, such as discussions on a joint workshop on archaeology / cultural heritage and on a dedicated event to target Palestine

SESAME

وزارة التعليم العالي والبحث العلمي

Palestinian-German ScienceBRIDGE
CONNECTING PEOPLE AND KNOWLEDGE

SESAME-PGSB Workshop

⇨ Online-Workshop on 16th November 2021 — 10^{00} to 13^{00} (EET) resp. 9^{00} to 12^{00} (CET)

5. ID11 - HESEB cont.

12 February 2023 – First users at HESEB

A collaboration among Jordanian Universities:

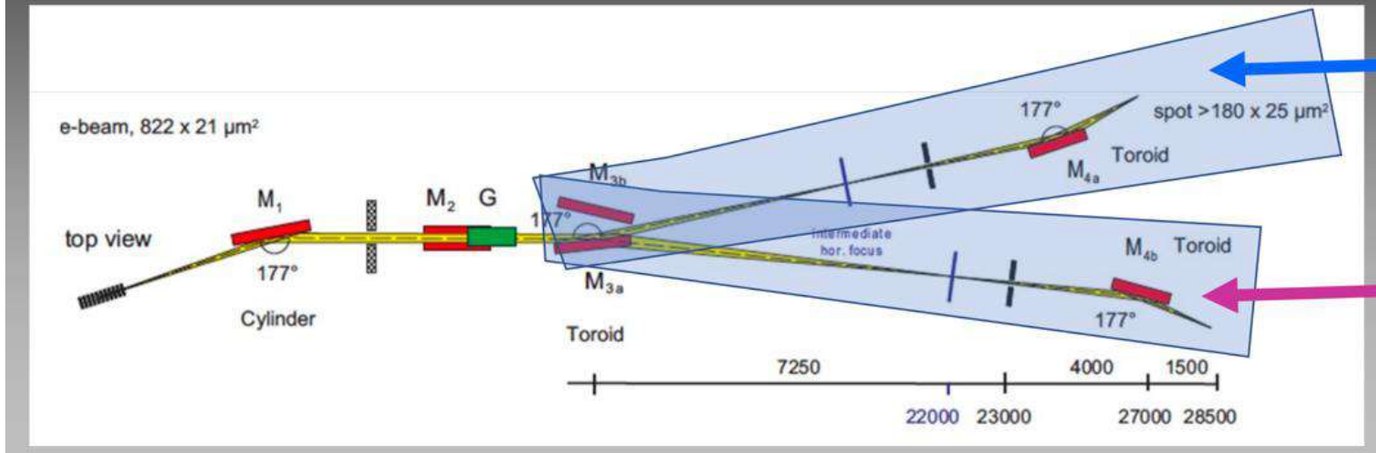
- Dr. Yusuf Selim Ocak (Institute of Nanotechnology, Jordan University of Science and Technology, Principal Investigator)
- Dr. Borhan Aldeen Albiss (Institute of Nanotechnology, Jordan University of Science and Technology)
- Dr. Bashar Aljawrneh (Al-Zaytoonah University of Jordan)

Using the HESEB beamline to study the electronic structure of samples and investigate the effects of dopants on semiconductor thin films. Data collected in three days from 9 samples at the absorption edges of O, Co, Ni, and Cu

New Beamline Initiatives
6. TXPES

TXPES TENMAK TÜRKİYE ENERJİ NÜKLEER VE MADEN ARAŞTIRMA KURUMU İhsan Doğramacı Bilkent Üniversitesi TARLA Turkish Accelerator and Radiation Laboratory in Ankara KOÇ UNIVERSITY

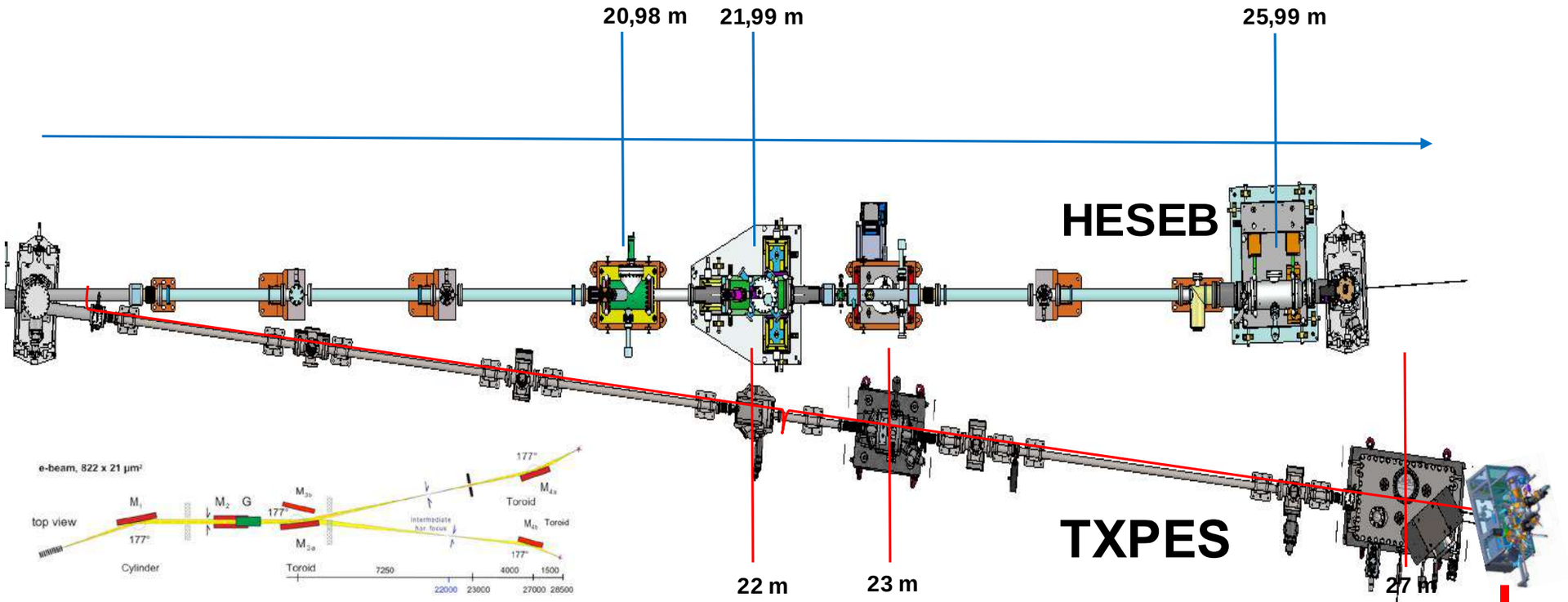
Complementarity of TXPES & HESEB Beamlines



HESEB Beamline

TXPES Beamline

6. TXPES X-ray Optics Design



Emrah Ozensoy, Bilkent University
Chemistry Department, Ankara, Turkey

TXPES

TENMAK

TARLA

KOÇ UNIVERSITY

Courtesy of: Baris Yildirimdemir (TARLA) byildirimdemir@tarla.org.tr
Also thanks to HESEB team and Rolf Follath

6. TXPES X-ray Optics Branch-line Design Review Committee

TXPES X-ray Optics Branchline Design Review Committee Members:

- **Raymond Barret:** *ESRF,* X-ray Optics Group Leader Instrumentation Services and Development Division
- **Kawal Sawhney**: *Diamond*, Head of the X-ray Optics and Metrology group
- **Jessica McChesney:** Argonne National Lab, X-ray Science Division

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6. TXPES End Station Components: Chamber

Analysis Chamber

- PHOIBOS 150 CMOS XPS/LEIS Analyzer
- XR 50: Dual Anode X-ray Source
- UVS 10: UV Source (for UPS)
- Electron Flood Gun
- Rastering Ion Gun for LEIS/Depth Profiling
- 4-Axis Manipulator with LN_2 Cooling & Resistive Heating to 1200 K

Preparation Chamber

- Ion Gun for Sputtering
- RF-Plasma Source
- Hydrogen Cracker
- LEED
- QMS
- Metal/Metal Oxide Evaporators
- Gas Dosers
- 4-Axis Manipulator with LN_2 Cooling & Resistive Heating to 1200 K

High-Pressure Chamber

- HPC-20 High Pressure Cell for Reactive Sample Pretreatment

Load Lock Chamber

- Sample Loading/Removal

TXPES

TENMAK

TARLA

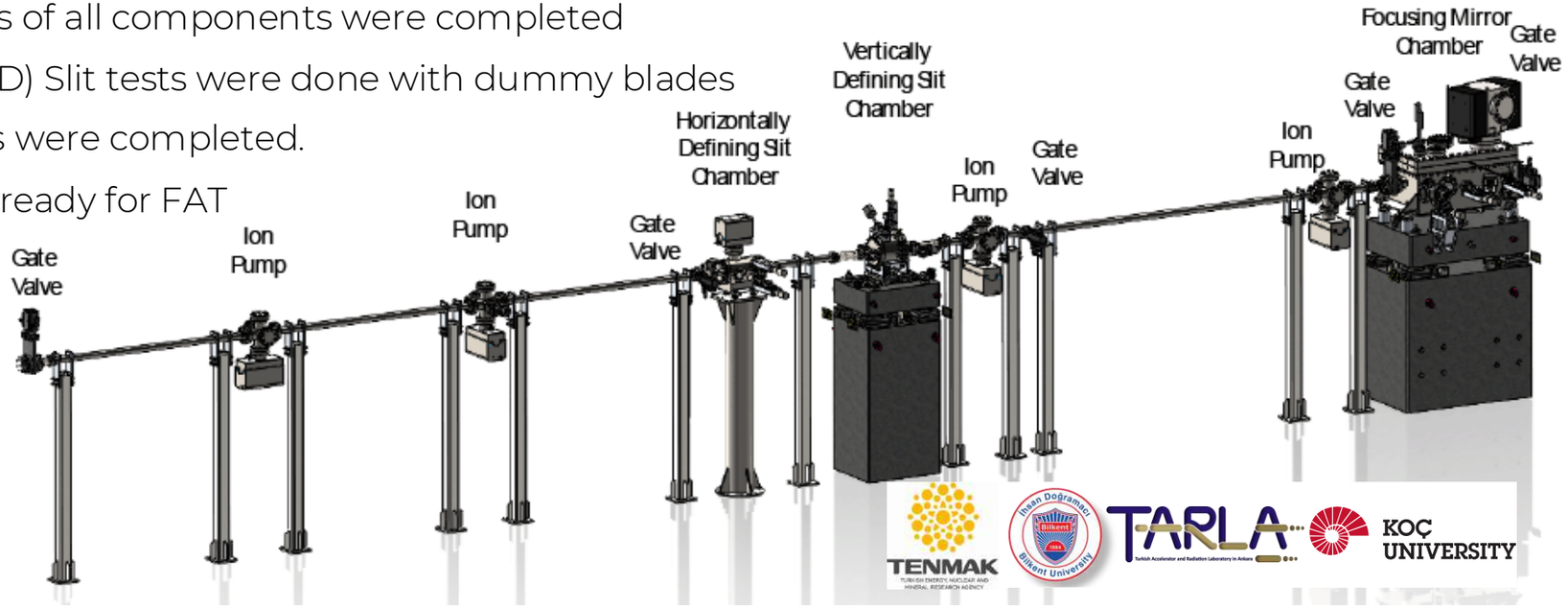
KOÇ UNIVERSITY

ID11 right – TXPES

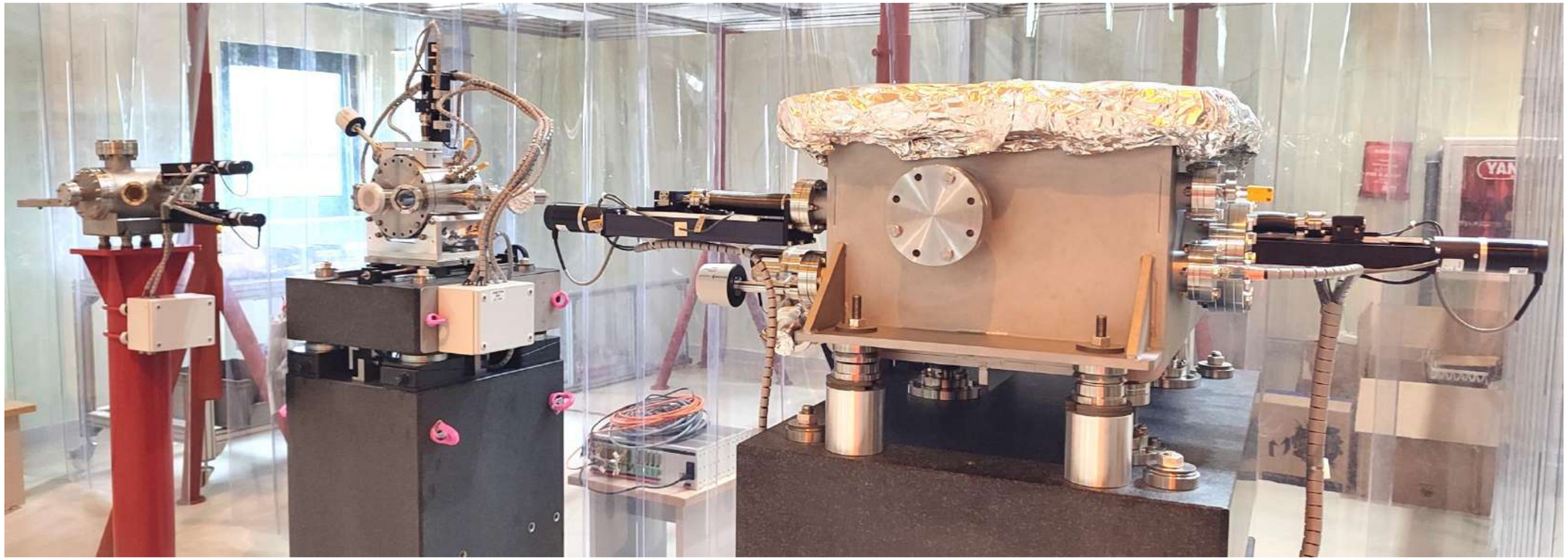
- Toroidal optics delivered. Only missing component: Energy (VD) Slit blades

Shipping expected February 2025.

- Initial tests of all components were completed
- Energy (VD) Slit tests were done with dummy blades
- Leak Tests were completed.
- System is ready for FAT



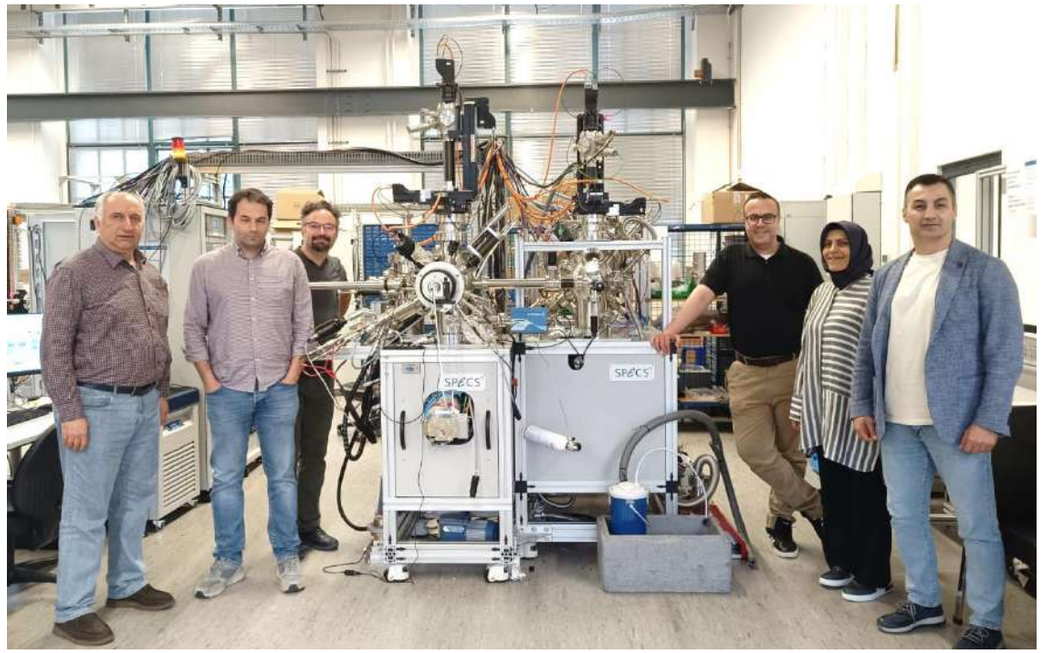
ID11 right – TXPES General Status of TXPES Beam Transport



byildirimdemir@tarla.org.tr

TXPES

ID11 right – TXPES End Station Manufacturing & Installation



Factory Acceptance Tests (FAT)

- FAT of the XPS end station were completed between May 28-June 1, 2024 at the SPECS headquarters in Berlin, Germany.
- FAT tests were carried out along with:
- Assoc. Prof. Sarp Kaya (Koc Univ., Istanbul)
- Dr. Zeynep Ozturk (SESAME)
- Dr. Mustafa Fatih Genisel (SESAME)
- Dr. Omer Kantoglu (TENMAK)
- Dr. Gencay Gundogdu (SESAME)
- After completion of FAT, end station was disassembled for shipment to SESAME.

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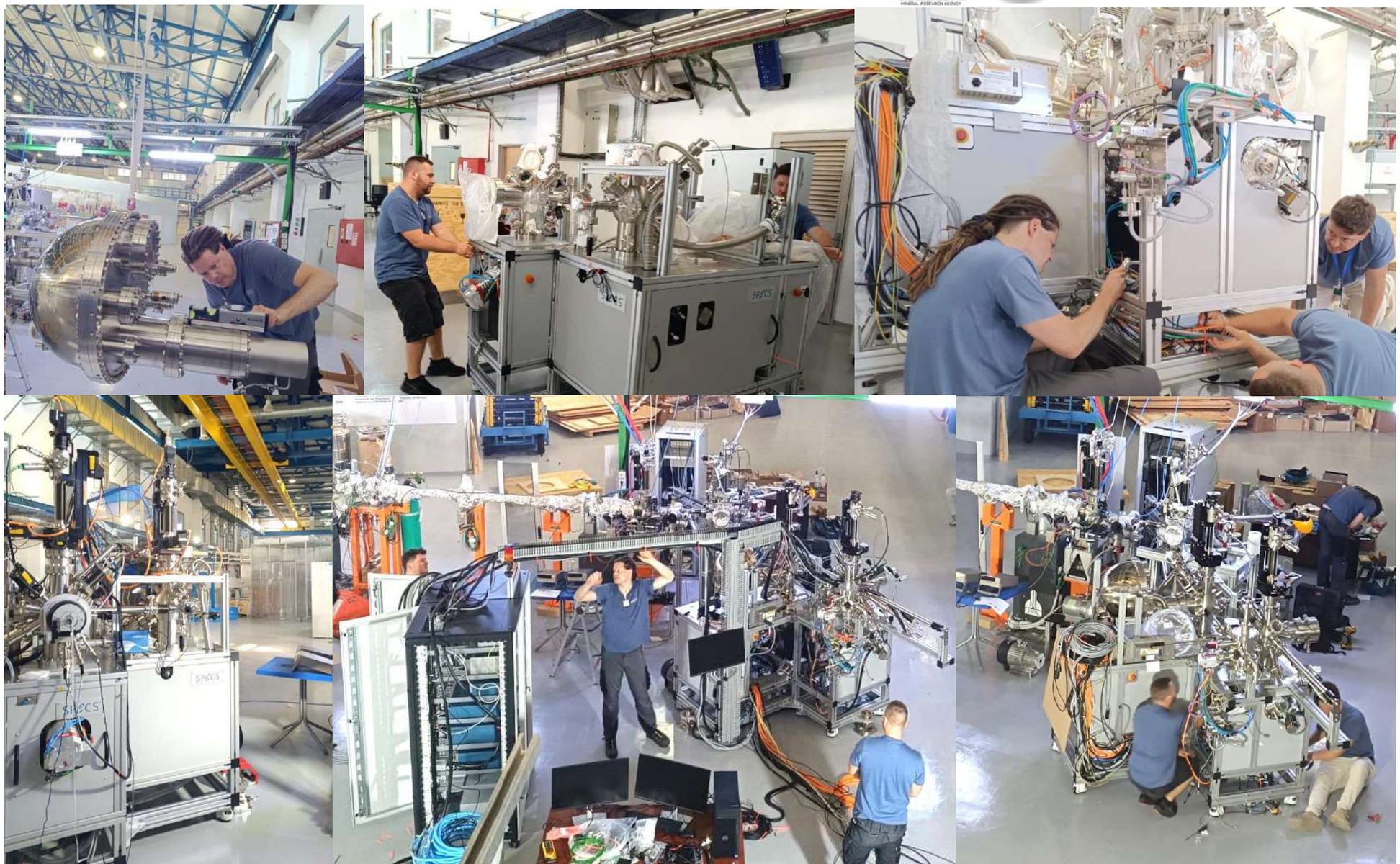
ID11 right – TXPES End Station Manufacturing & Installation

SPECS & TENMAK Staff Comes to SESAME For Installation on September 23, 2024

SPECS & TENMAK Staff Comes to SESAME For Installation on September, 2024



ID11 right – TXPES End Station Site Acceptance Test December 2024

SPECS technical staff poses near the newly installed experimental chamber together with representatives of the TXPES project and SESAME staff.

New Beamline Initiatives

7. Crystallography

8. SAXS

A flexible crystallography beamline with capabilities for macromolecular crystallography in the Middle East would allow increasing the SR community, while also facilitating experiments in the medical and pharmaceutical fields in the region and beyond.

A SAXS beamline would significantly empower Middle Eastern and African scientific communities by enabling cutting-edge research, especially for biological structures and processes.

Together, these two instruments would represent a key asset in advancing healthcare solutions, pharmaceutical developments, and interdisciplinary collaboration across the region.

Guest-House Inauguration on December 4, 2019

SESAME Guest-House was funded by the Italian Ministry of Education, Universities and Research through INFN (total of 1.75 M Euro). The Guest-House includes a canteen, large meeting room and 48 Guestrooms.

Guest-House Funding

Project Information	
Funded by	**Italian Ministry of Education, Universities and Research through INFN**
Donation	**1.75 million Euro**
Actual Cost	**2.095 million Euro**
Consultants	**Integra A.E.S Roma-Italy** **Consolidated Consultants Group (CC) Amman – Jordan**
Construction Completion	**15-5-2019**
Testing & Commissioning	**1-7-2019**
Inauguration	**4-12-2019**

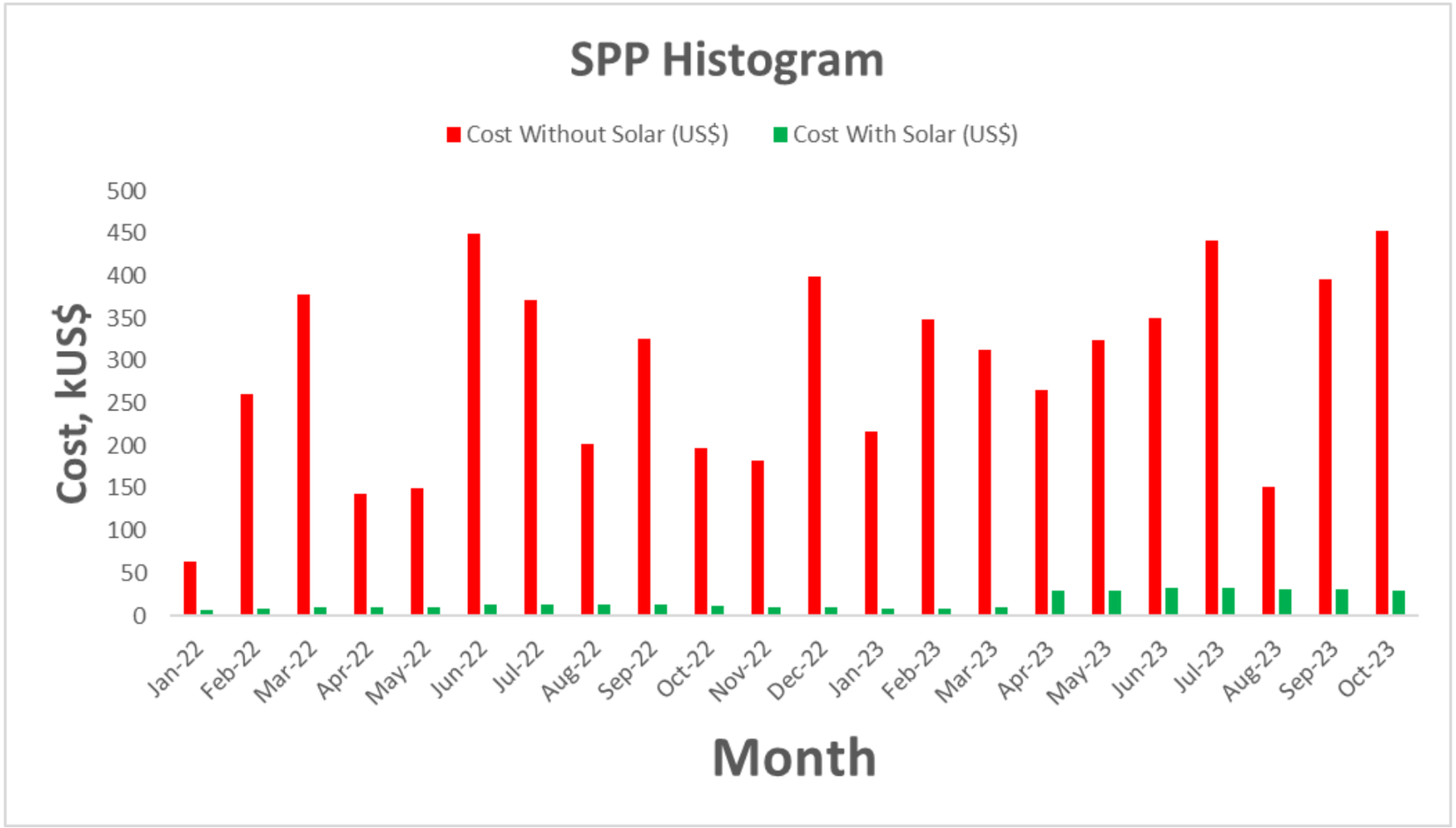
Guest-House Meeting Rooms

Solar Power Plant: Current Status

Financial Impact

Start Date of Operation	February 28th , 2019
Total Initial Investment	7,143,938 US$
Lifetime of the PV system	20 years
Peak Monthly Bill Prior to Solar Plant (Oct. 2023)	452,617 US$
Average Monthly Bill (Including Wheeling) Present	30,000 US$
Pay Back Period	2 Years
CO_2 Reduction:	~ 7,000 ton/year

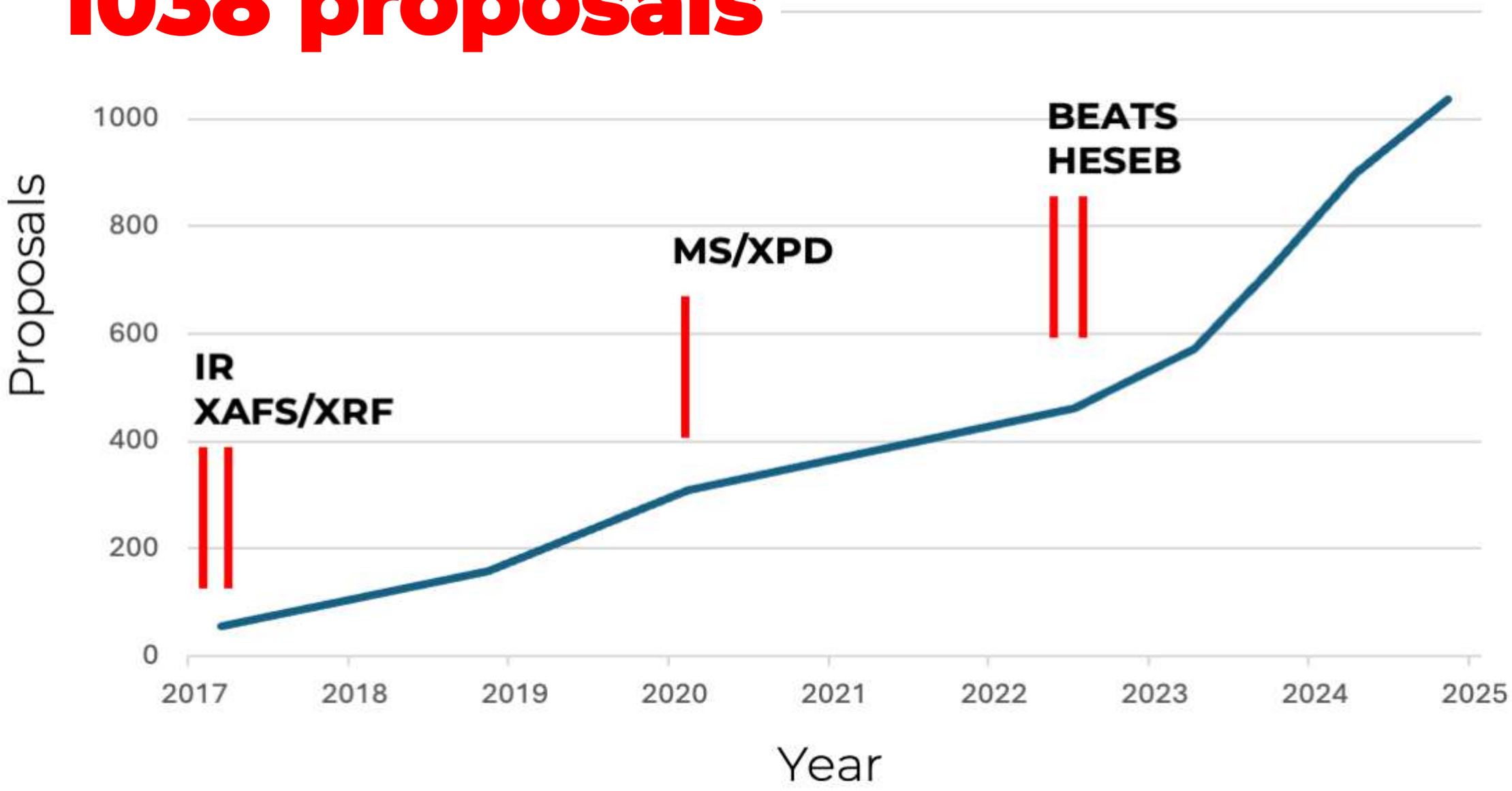
Comparison Chart of 2022-2023



SPP Data 2019-2024

Year	Production, kWh	Consumption Power, kw	Cost, US$		Savings, US$	Saved CO_2, Ton
			With SPP	Without SPP		
2019	9,541,970	7,127,380	112,041	2,677,801	2,565,760	6,233
2020	9,318,793	5,676,520	108,182	2,132,704	2,024,522	6,087
2021	11,529,373	9,726,160	137,238	3,654,179	3,516,941	7,531
2022	10,812,209	8,318,220	127,778	3,125,207	2,997,429	7,062
2023	10,747,999	10,743,270	295,274	4,036,313	3,741,039	7,021
2024 Jan-Sep	8,211,784	8,232,740	264,475	3,093,092	2,828,616	3,163
Total	**64,002,263**	**49,824,290**	**1,044,989**	**18,719,295**	**17,674,306**	**37,096**

1038 proposals



SESAME Proposal Review Committee

Samar HASNAIN (Chair), University of Liverpool, UK

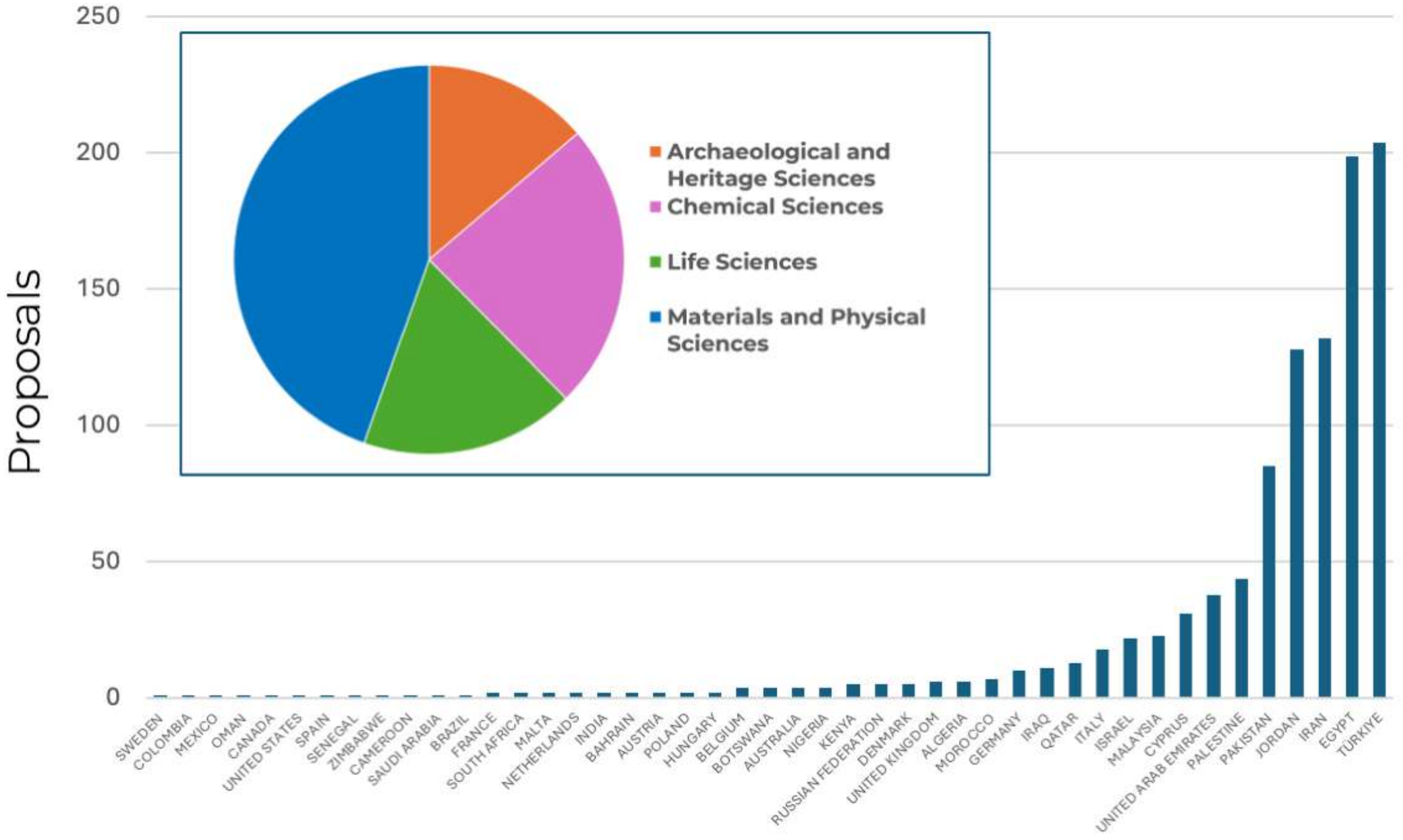
Archaeological and Heritage Sciences	
Mariangela CESTELLI GUIDI (coordinator)	INFN, Italy
Francois FAUTH	ALBA Synchrotron, Spain
Caroline JACKSON	University of Sheffield, UK
Costanza MILIANI	CNR, Italy

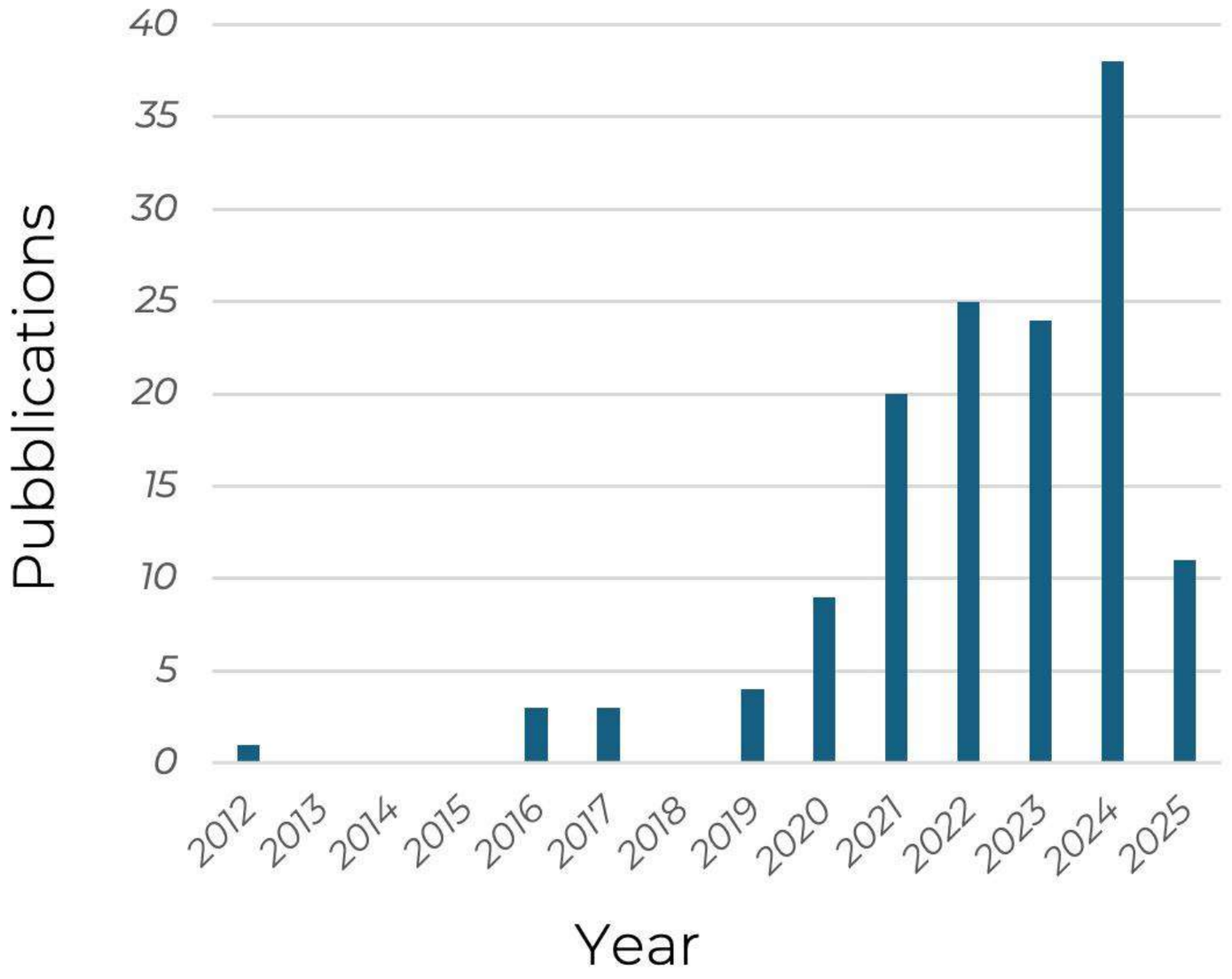
Chemical Sciences	
Sofia DIAZ-MORENO (coordinator)	Diamond Light Source, UK
Thomas ELLIS	University of Saskatchewan, Canada
Antonella GLISENTI	Univertity of Padova, Italy
Sarp KAYA	Koç University, Turkey

Life Sciences	
Michel HOUGH	Diamond Light Source, UK
Christophe SANDT	Synchrotron SOLEIL, France
Zehra SAYERS	Sabancı University, Turkey
Lisa VACCARI (coordinator)	Elettra Sincrotrone Trieste, Italy

Materials and Physical Sciences	
Muhammad Javed AKHTAR	PINSTECH, Pakistan
Andrew FITCH (coordinator)	ESRF, France
Bruce RAVEL	NIST and NSLS II, USA
Brian ROSEN	Tel Aviv University, Israel

523 proposals approved


Proposals
250
200
150
100
50
0
Archaeological and Heritage Sciences
Chemical Sciences
Life Sciences
Materials and Physical Sciences
SWEDEN
COLOMBIA
MEXICO
OMAN
CANADA
UNITED STATES
SPAIN
SENEGAL
ZIMBABWE
CAMEROON
SAUDI ARABIA
BRAZIL
FRANCE
SOUTH AFRICA
MALTA
NETHERLANDS
INDIA
BAHRAIN
AUSTRIA
POLAND
HUNGARY
BELGIUM
BOTSWANA
AUSTRALIA
NIGERIA
KENYA
RUSSIAN FEDERATION
DENMARK
UNITED KINGDOM
ALGERIA
MOROCCO
GERMANY
IRAQ
QATAR
ITALY
ISRAEL
MALAYSIA
CYPRUS
UNITED ARAB EMIRATES
PALESTINE
PAKISTAN
JORDAN
IRAN
EGYPT
TÜRKIYE

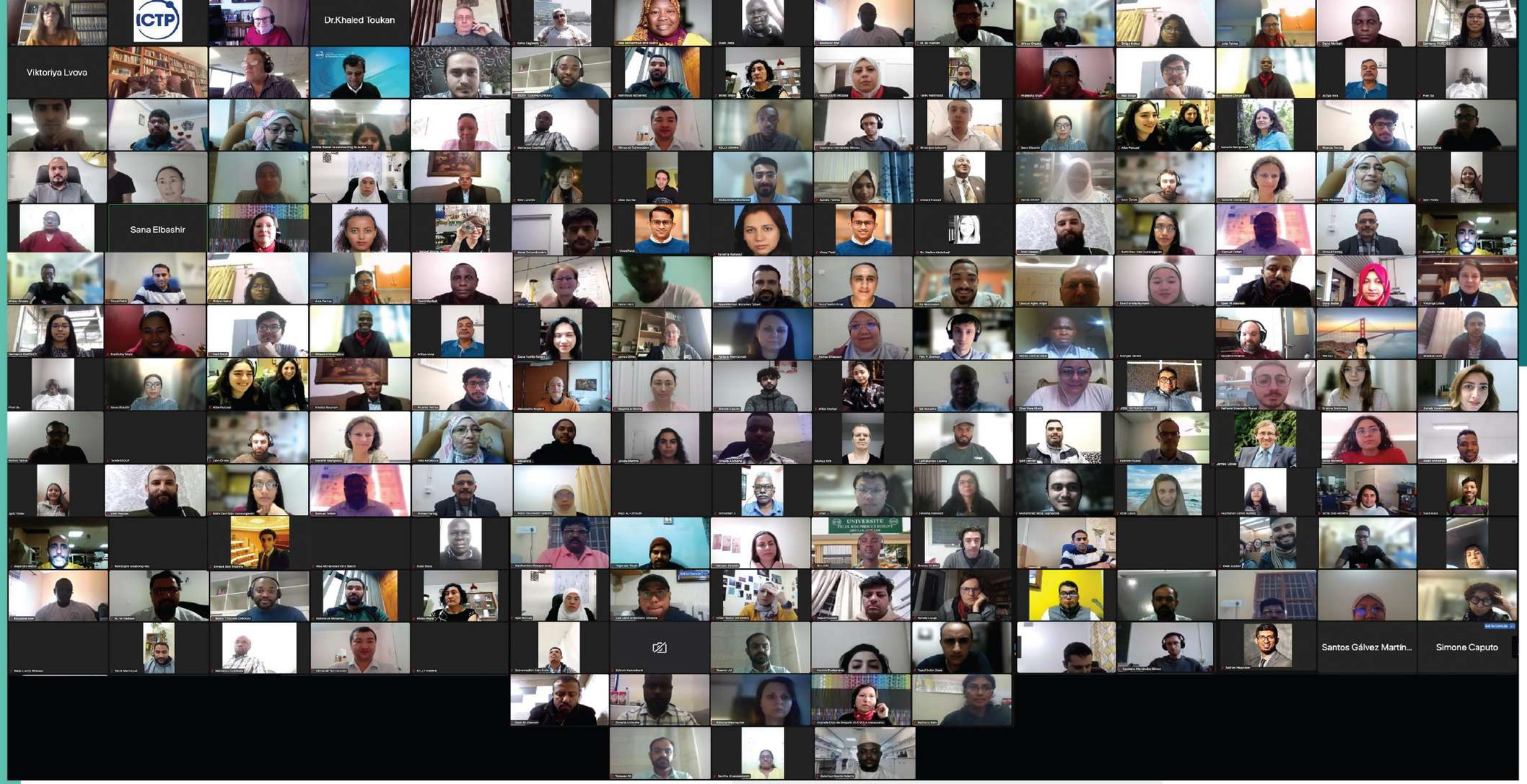


138

peer-review publications until March 2025

- **Average IF > 5**
- **20% of publications have IF > 7**

6-7/5/2023 **SESAME 18th Users' Meeting, the first after COVID**



SESAME

LAMP
Lightsources for Africa, the Americas, Asia, Middle East and Pacific

ESRF
The European Synchrotron

15 - 26 January 2024

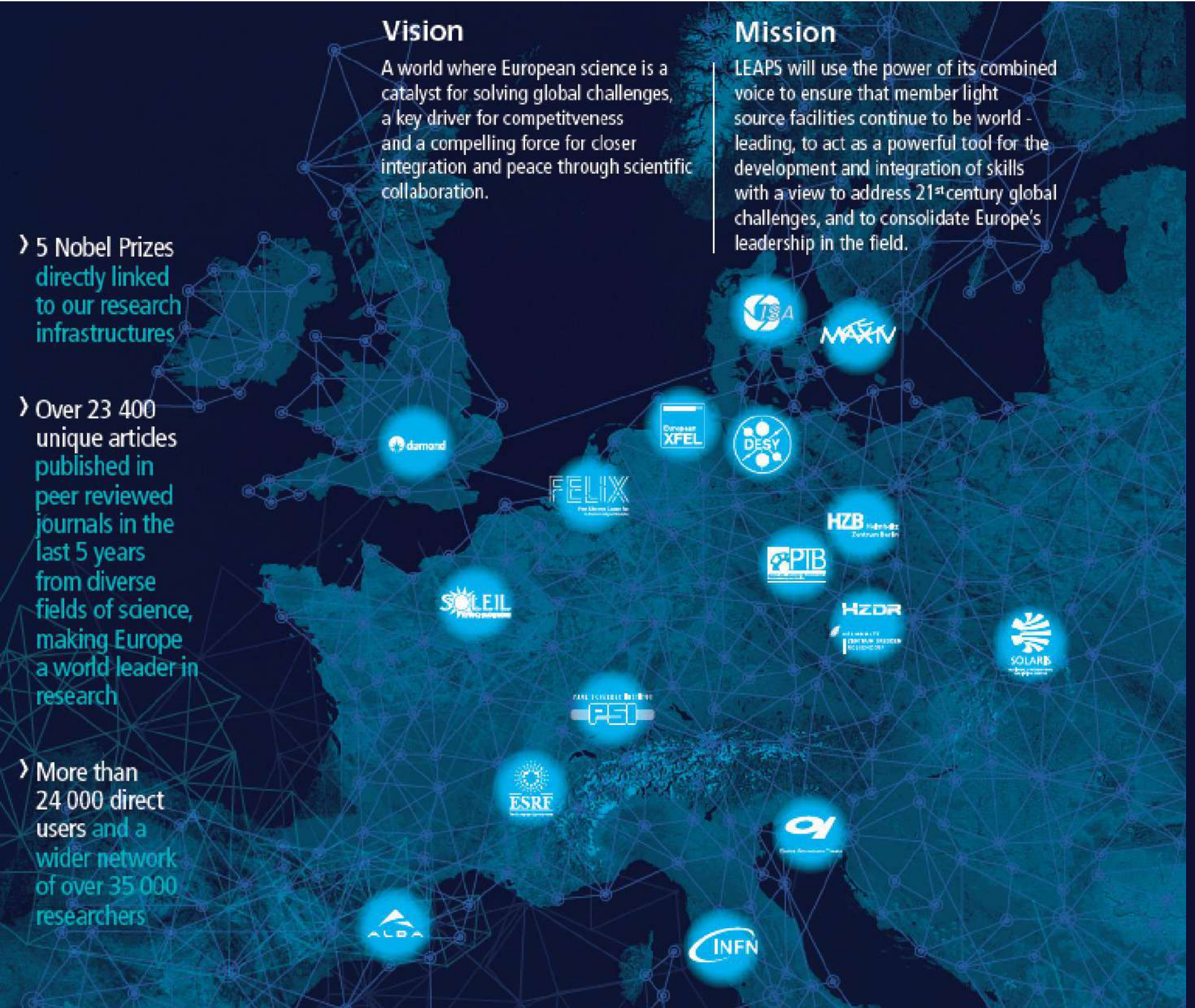
Vision

A world where European science is a catalyst for solving global challenges, a key driver for competitveness and a compelling force for closer integration and peace through scientific collaboration.

Mission

LEAPS will use the power of its combined voice to ensure that member light source facilities continue to be world - leading, to act as a powerful tool for the development and integration of skills with a view to address 21st century global challenges, and to consolidate Europe's leadership in the field.

- 5 Nobel Prizes directly linked to our research infrastructures
- Over 23 400 unique articles published in peer reviewed journals in the last 5 years from diverse fields of science, making Europe a world leader in research
- More than 24 000 direct users and a wider network of over 35 000 researchers



LEAPS:
the League of European Accelerator-based Photon Sources
groups
the major “Photon Factories”
in Europe

In November 2018, SESAME become the 1st Associate Member of LEAPS

SUNSTONE

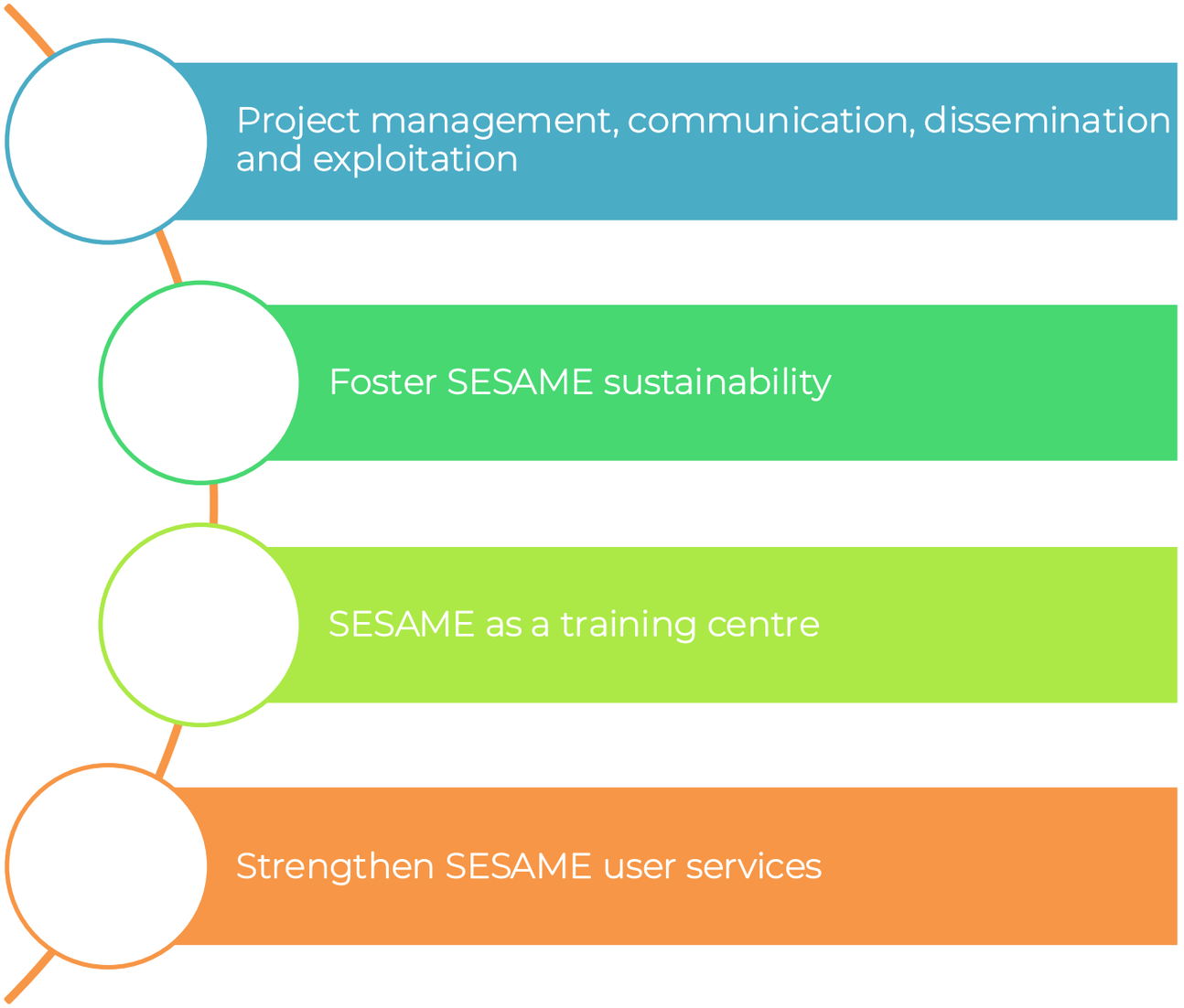
SESAME'S UPGRADING NETWORK FOR SCIENTIFIC USER TRAINING AND OUTREACH INTO THE NEXT ERA

Special call: "Strengthening the international dimension of ESFRI and/or ERIC research infrastructures - consolidating the SESAME facility"

- **Coordinator: ESRF**
- **Budget: 1.5M€, of which 1.0M€ to SESAME (staff, other costs, overheads) + funds from State Secretariat for Education, Research and Innovation (PSI)**
- **Project duration: 42 months**
- **Beneficiaries (as named in the EC call): ALBA, CYI, DESY, ELETTRA, ESRF, INFN, SESAME and SOLEIL; and PSI as Associate**
- **Start 01 June 2024**

SUNSTONE

SESAME'S UPGRADING NETWORK FOR SCIENTIFIC USER TRAINING AND OUTREACH INTO THE NEXT ERA

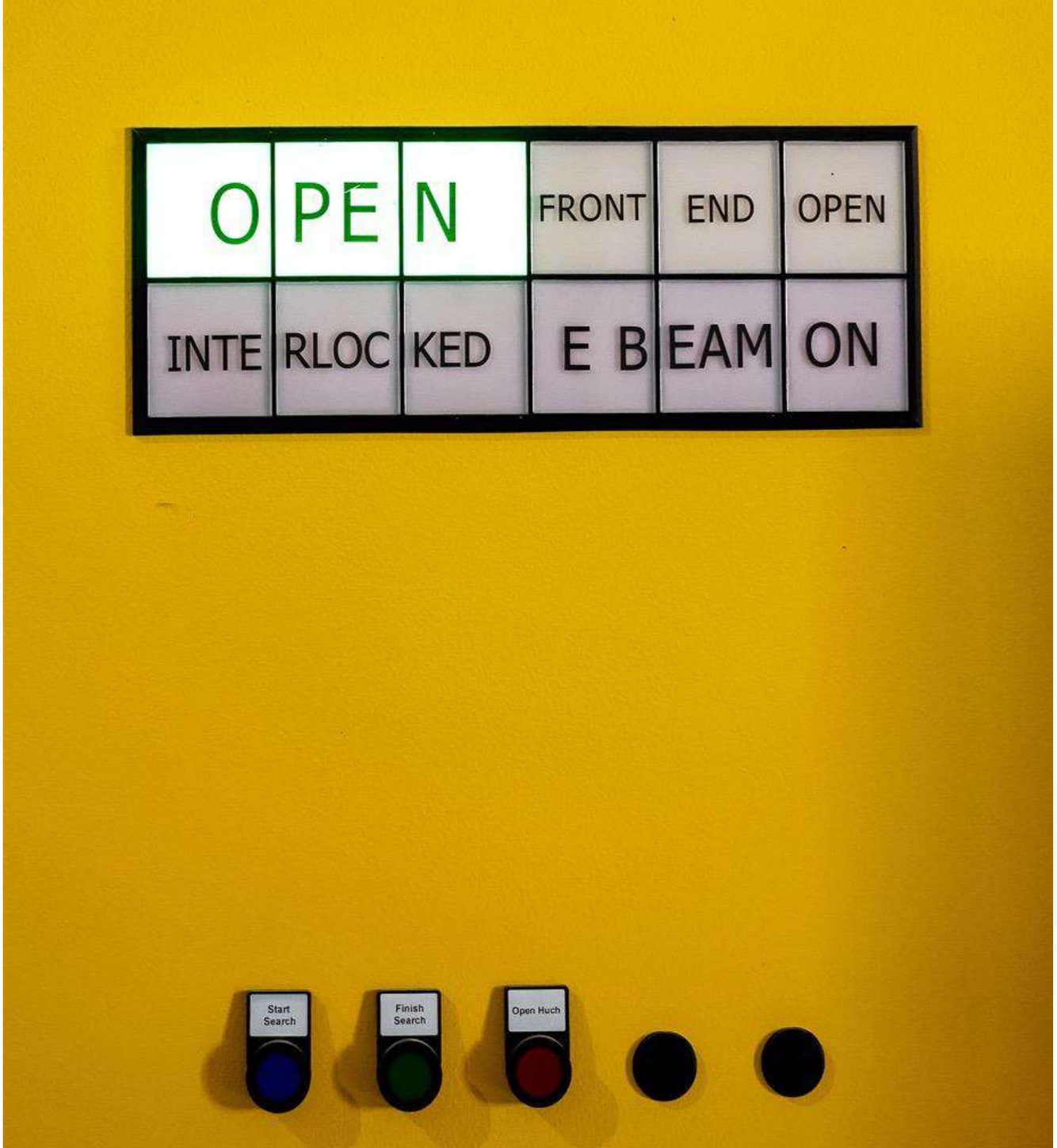


LEAD: ESRF with co-leader SESAME

LEAD: PSI with co-leaders DESY and SESAME

LEAD: SOLEIL with co-leader INFN

LEAD: ALBA-CELL, with co-leader Elettra



Outlook

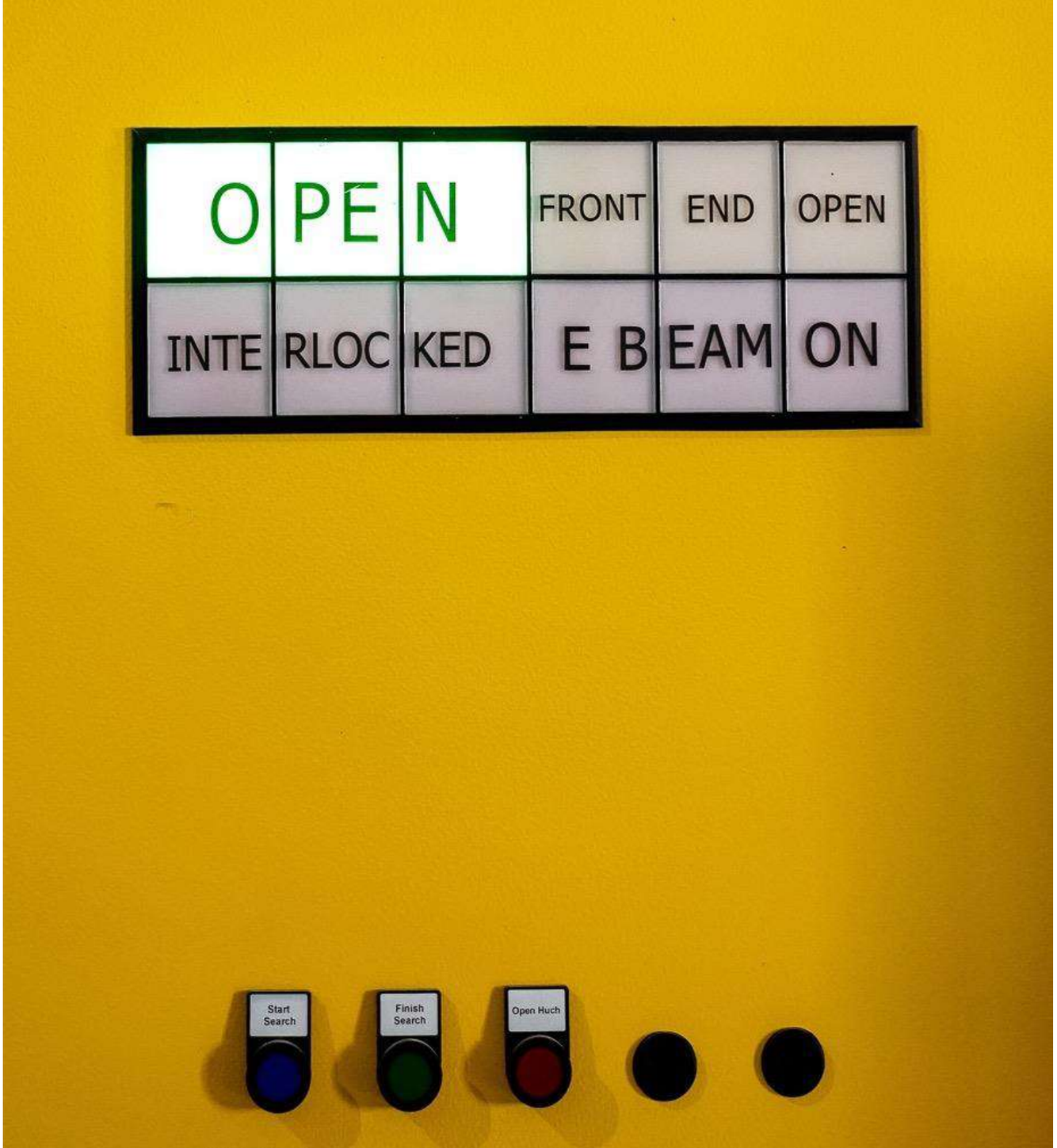
SESAME is open and produces world-class science

SESAME is an internationally well-connected facility

Challenges: securing remaining capital, attracting new members, managing financial disparities.

Travel restrictions and political tensions present ongoing issues.

andrea.lausi@sesame.org.jo


OPEN
FRONT
END
OPEN
INTERLOCKED
E BEAM ON
Start Search
Finish Search
Open Huch

Thank you